# JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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## EDITORIAL NOTES—GAS, &c.

### Modern Conditions in Coal Contracts.

TWELVE months ago, the proprietors of a Suburban Gas Company, well favoured in administration and prosperity, were informed that the Directors had purchased part of the coal requirements for the then ensuing year at the same rates as the previous one, but with the condition attached that, in the event of there being an increase in miners' wages, the Company would contribute their proportion of such increase. It seems that insistence on this condition on the part of colliery proprietors is spreading; and it has now attracted the attention of the "Iron and Coal Trades "Review," which devotes to it a special article. The wages clause is not the only recent insertion of new conditions in coal contracts; and buyers are accused of having been the cause of these fresh stipulations by the irrational terms they impose upon sellers desirous of securing their business. Municipal and other public bodies are charged with being the worst offenders in this respect. However that may be, the miners' wages clause and other innovations of the kind, we are given to understand—by magnifying to its proper meaning the statement that the collieries have been "actuated, per- "haps, by a very natural desire that all the advantages should "not be on the side of buyers"—are merely retaliatory or counterbalancing measures. That this is the whole truth we do not believe. At the same time, the "JOURNAL" has consistently advocated the simplest form of contract possible, with as few encumbering and unnecessary conditions as possible —in fine, a contract just sufficient to cover the obligations of both parties to the bargain. It must, however, be admitted that several gas undertakings in their contracts—we have been made acquainted with a few—impose most absurd conditions; and such undertakings cannot complain when there are reprisals. Nevertheless, in the cause of honest traffic, such conditions cannot be approved. They do not facilitate business; and we therefore hope that all extrinsic stipulations of the kind will be weeded out where they exist, and be declined where there is no justification for their insertion—unless some equivalent for such clauses as that referring to miners' wages can be obtained, and then only when prices are at a normal or reasonable level, and not in such times as the present of abnormal and unreasonable demand on the part of the coal owners.

It appears, from the information in the "Review," that the wages clause has been insisted upon not only in selling to buyers having no connection with the coal trade except as consumers, but also in doing business with merchants and factors. When coal contracts were being settled on the London Coal Exchange last year, there was considerable friction over this matter. "Collieries then endeavoured to "secure the acceptance of the principle that the price to be "paid should be regulated to an extent by miners' wages; "that it should rise when wages rose, and fall when they "declined. Although buyers very strongly resented the "clause, and many refused point-blank to entertain it, it "found its way into many contracts." This insistence on the clause in the case of coal merchants and factors indicates that the "natural" desire to get level with municipalities and companies buying under contracts, containing onerous and one-sided terms, is a lame excuse; seeing that the merchants and factors are not great sinners in imposition of the nature suggested. However, a determined effort is being made this year to keep the clause alive; and large buyers are being asked to agree to 3d. per ton advance or decline for every 5 per cent. increase or decrease in miners' wages. It is also intimated that a clause of a similar character in relation to the Miners' Eight Hours Bill is being inserted in contracts, which is "taking Time by the "forelock" with a vengeance. We are very much in accord with our contemporary in this matter of extraneous clauses, and, with it, are of opinion that it is better to have an average contract figure and avoid the element of uncertainty introduced by this sliding-scale arrangement. If it was introduced into all commerce subject to contracts, it would be almost impossible for the manufacturer to make approximate calculations as to the future, and to fix prices for his productions for anything but short periods ahead. Such conditions, as they extend, only promote complication; while simplification in business should be the order of the day.

### Cheaper Gas and Scientific Progress in Manufacture.

ALTHOUGH addressing an informal meeting of Scottish Gas Managers, there was no informality about the address that the Chairman (Mr. J. W. Napier, of Alloa) delivered last Wednesday in Glasgow. It was an eloquent and well-considered disquisition upon the higher topics that are at present engaging the thoughts of the intellectuals of the gas profession. The gas engineers and managers who heard the address are to be congratulated on their Chairman, and the Alloa Gas Commissioners on the possession of an Engineer and Manager of such mindful and penetrating proclivity in the diverse affairs of his professional duties. The address puts a firm brace on the relationship that exists between the technical work of manufacture and the commercial work of selling gas. The effects of the one upon the other are reciprocal; and their bonds are therefore indissoluble. We may pass over the Chairman's remarks on the coal question, as they reflect the spirit of the views to which expression has been of late given in these columns; and this brings us at once to a few of the points of technical importance bearing upon the future production of cheap gas. That cheap gas is the need of the day, is the consideration with which Mr. Napier both fronts and ends his address. Where are we to look for progress in realizing conditions enabling greater cheapness of supply? Greater business is one means; but the creation of the greater business rests primarily on cheapness of production, and secondarily on the conveniences and economies in use that can be offered. In the address the answer to our question is given in these words: "Low selling price of gas will be reached by carry- "ing out our operations on scientific lines; producing a "larger volume of gas, reducing labour costs, and obtaining "a larger nitrogen value for our ammonia." We may add, and producing less tar, and getting from it a valuable return in the gas, instead of enlarging the output, as the increased gas business must otherwise do, yielding a drug instead of a valuable commodity.

The vertical retort is looked upon with confidence by Mr. Napier as one means of putting carbonizing practice upon scientific lines; and in mentioning this on such an occasion and in such a meeting, the name and work of Mr. William Young could not be omitted. One point, in treating of this form of carbonization, upon which the Chairman laid stress was that of the admission of steam into vertical retorts; and herein he detects what he believes to be the most hazardous part of the process. If we read Mr. Napier's observations correctly, his inclination, moulded by the experience and practice in distillation for the manufacture of paraffin oil, is in the direction of the admission of large volumes of steam to increase the yield of ammonia, as opposed to the introduction of regulated limited quantities. Ammonia is not the one and main thing to be considered; and as the objects of distillation in the shale-oil works are dissimilar to those in a gas-works, we can only, in a limited degree, apply the experiences arising from the practice in the former works to the requirements of the latter. When pondering the relative advantages of the admission of large volumes of steam and of regulated quantities, the experiences of the Mond gas people appear to be rather more apposite; and there we find that, with considerable introduction of steam and a high yield of ammonia, the gas and other products are decidedly bad. As we have recently pointed out, technically it is practically

impossible for a high yield of ammonia to go hand in hand with the production of a large quantity of gas of good quality, even if the coke and other residual solid fuel is wholly sacrificed. In the Dessau vertical retort, steam was tried and discarded, owing to the effect on the products other than ammonia and on the retorts themselves. From unregulated supply of steam, the trials at Bournemouth have reached regulation and limitation; and with steam so used in that continuous system, the effects are found to be beneficial in increased yield generally, and in preventing the injurious baking of the coke, in its long-period passage through the retort. With such diversity of experiences, this question of liberal or limited steam admission must be regarded with reservation, until careful investigation in conjunction with vertical retorts for the production of gas for ordinary purposes admits of positive declaration. Saying which is tantamount to adopting the remark in the concluding part of this section of Mr. Napier's address, that "the conditions "under which ammonia is produced from coal require to be "carefully studied, more especially where the process is "carried out in the same retort in conjunction with making "coal gas."

Succeeding parts of the address invite comment; but we must repress the temptation. Briefly, however, it may be mentioned that the system of charging and discharging retorts from one side of the bench has in Mr. Napier's eyes, as it has in fact, brought in its train many economies in constructional and working practice, which all contribute to the one end—the cheapening of production. The retort-house governor and the hydraulic main seal-dispensing device are commended; and on many of the other questions dealt with, interest is claimed both by the method of the Chairman's treatment and the independence of inquiry that has produced individual experience. We get back to the question of cheap gas in the section dealing with differential rates. The success so far of suction and other producer gas plants has brought conviction to many minds that there is a demand for cheap gas of a quality less superlative than that supplied by most of our Scottish friends, and that manufacturers who require considerable quantities will have it. Thereby exists the necessity for making concessions in price, in order to meet competition for a valuable day-load factor. A low flat-rate for all purposes is, of course, the ideal thing; but what is the ideal thing in the eyes of the gas maker is not always the ideal thing in the eyes of the buyer, who is independent of the gas maker if he cannot compete with other means of satisfying requirements. Mr. Napier gives a table showing the costs applicable at Alloa to gas made for ordinary purposes and the costs applicable to gas for power use; and the items of that table are worth the consideration of every gas engineer, and of application, *mutatis mutandis*, to the individual circumstances of every undertaking. They at all events prove that at Alloa a price of 1s. 6d. per 1000 cubic feet for good custom for industrial use admits of a clear profit, to go to the benefit of the undertaking and its patrons generally. In the arguments which accompany the table appear figures as to capital employed at Alloa per million and per thousand cubic feet of gas made; and on these figures we compliment both Mr. Napier and those he serves.

Altogether the address is a valuable and illuminating one; and we hope that it will act, technically and commercially, as an incentive, and will also effect what Mr. Napier so ardently desires, the tightening of the bonds of organization in the gas profession throughout the United Kingdom, by the inclusion in the scheme of affiliation with the Institution of Gas Engineers of the representative body of Scotland.

## To Amend the Patent Law.

The Bill that Mr. Lloyd-George has presented to the House of Commons to amend the law relating to patents and designs has had popular acceptance; in technical circles, it has met with mixed approbation and disapproval. But most men concerned with patents and industry, even those most ardently antagonistic to certain of the provisions of the Bill, find something good in it. Its design is to simplify and cheapen procedure, and to protect British invention and industry; and, this being so, it must receive sympathetic consideration and not hasty condemnation. The Patent Law requires amendment. That is admitted generally, not omitting those who, like Mr. Dugald Clerk, believe that in our patent system we have something that is far better than the systems of other countries. Better though it may be, it can be further perfected by copying certain of the details from foreign systems, and by innovation on our own part. The greatest fault of the present Bill is perhaps that its scope has not been made more extensive while the work was in hand. However, it is the introduction to an attempt to bring about improvement to the advantage of this country; and it is a step towards a far larger proposal, taking the shape of a Consolidation Bill, which, when it sees the light, will be remitted to the Grand Committee on Trade. There will then be the opportunity for wiping out further defects, and for modifying and supplementing where needed.

The most controversial part of the Bill is that referring to the compulsory working of patents within a period of three years, unless the patentee can show satisfactory reasons for not having manufactured in this country. The Government recognize that the privileges granted to foreign inventors through the Patent Office may be, and is, used to the detriment of British industry and the public. Last year some 14,700 patents were issued, and of them 6500 were exotics; and it is asserted by the President of the Board of Trade that many of these patents were taken out not for the purpose of working them in this country, but with the sole intent of preventing them being worked here. Our Patent Laws ought not to be in such a condition of leniency that they can be used in any way to the detriment of the country or the development of British industry. We believe fully in the intelligence, the ability, and the ingenuity of every inventor, whether British or foreign, being fully rewarded; but we do hold, too, that for the protection of his rights to that reward, and for the capital and markets offered to him, he owes something to the country that gives these things to him. The encouragement should not be all on one side. The economics of this question of compulsory working, regarded nationally, has been discussed in certain quarters in a somewhat one-sided manner. It is assumed that, under a system of compulsory working, the interests of industry and of the consumer are brought into conflict; that the advantage will be reaped entirely by the industry affected, and that the consumers of the produce will suffer by the shutting out of the similar productions of foreign countries, which productions are probably there manufactured more cheaply. This is pure fiction. The Bill does not entertain any idea of debarring a foreign inventor from our markets; but it does—unless he can give "satisfactory reasons" for not adequately manufacturing in this country—propose to rescind the protection afforded him under certain conditions. He will still be able to compete; and if he can produce and deliver to the consumer more cheaply than manufacturers can do in this country, then he will, by his own superiority in this respect, provide his own palladium. A substantial amount of sophistry has been trotted out over this question of cheapness; cheapness being a subtle argument with consumers. A cheap article, produced abroad, may tend to a small economy on the part of the consumer. We have to weigh that single advantage against the development of home industry, and all that it brings in its train in the creation of labour, and the giving to labour of greater buying power to the benefit of other home industries. Home industry creates and enlarges buying powers; purchasing goods made in other countries (unless it is impossible to manufacture them in this country) does not do so in the same degree. As a matter of fact, taken through and through, no conflict is established by the Bill between the interests of home industry and those of consumers; it is not a Manufacturers' Bill in which the interests of British consumers are sacrificed—for the consumers and the workers and investors are identical. There is evidence, at any rate, that the Board of Trade have tried, if they have not succeeded in pleasing everybody, to hold the scales of justice fairly between the inventor, whether British or foreign, and the industries and labour of this country.

Glancing at a few other points in the Bill, provision is made for averting that obscurity and vagueness by which many patentees in chemical invention endeavour to cover a larger field than that immediately compassed by their individual discoveries, and which obscurity and vagueness has been the cause of no end of trouble and litigation. It is contemplated that, if required, samples of chemical inventions shall be deposited. Mr. Dugald Clerk, in his Society of British Gas Industries address, pleaded that "patents of "addition" should be granted without renewal fees. In Germany, France, and Italy, such patents of addition are granted at a date later than the original patent, but expiring always with the original one. The Bill proposes precisely the

same thing. But it is to be left to the option of the patentee whether an improvement on an invention comes under this useful provision. The option annuls the criticism that has been levelled against the provision, on the ground that it is fatal to the object that an inventor has in taking out supplementary patents—viz., the prolonging of his monopoly. The Bill has also excellent intentions on behalf of the poor patentee, in alleviating his costly lot. From the beginning, under existing circumstances, the expenses of protection are heavy for him; and if litigation is forced upon him by powerful adversaries to support the validity of his claim, his very ingenuity may mean his material ruin.

The Bill provides for a longer time for sealing patents in certain cases; and for applications for an extension of time for the payment of fees, &c. It is in accord with Mr. Dugald Clerk's way of thinking that the Comptroller of Patents should be invested with greater judicial authority, with appeal from him to one of the High Courts. It is proposed by the Bill to put into the hands of the Comptroller the power of revocation (except during the pending of an action for infringement) on one or more of the grounds on which the grant of a patent may be opposed. The idea of Mr. Lloyd-George is that all appeals from the Comptroller shall be dealt with by one Judge, whose cumulation of special experience will be very valuable in this branch of litigation. In the same way will be dealt with the question of the revocation of a patent not manufactured within three years in this country, unless satisfactory reasons can be submitted why the invention is not so manufactured. The Comptroller is likewise given the power of reasonable extension of such patents beyond the period of three years; so that there is possible mitigation here of any assumed hardship, which mitigation would be brought into operation in the case of such inventions as require a maturing term of more than three years. Petitions for compulsory licences it is intended shall take the same economical course, instead of compelling a petitioner to go before such an expensive tribunal as the Judicial Committee of the Privy Council. A further clause makes unlawful the imposing of conditions on the use of patented articles, which have the effect of restricting the purchaser, hirer, or licensee from employing in his trade or industry any article acquired from any person other than the one by whom the condition is imposed. It will be remembered that during one of the old Welsbach Company's cases, in which the question of the use of the Company's mantle on their own burner was involved, it was held that an inventor could impose his own conditions.

On the whole, we do not think the measure is one against which any very serious objection can be laid. Where it assails, the protection of appeal is provided. And it should not be forgotten that charity, tempered by justice, must begin, though not end, at home.

## Methane-Hydrogen Gas.

An article in another column on the development of the methane-hydrogen gas system, in special reference to its installation at the Swindon Gas-Works of the Great Western Railway Company, raises certain considerations that are very applicable to the conditions under which the gas industry is working at the present time. Coal has gone up in price; and the residuals of coal carbonization are being produced on an ever-extending scale, and, regarded in the aggregate, there is nothing immediately visible giving hope that residuals will show any substantial improvement on what obtains at present. Coincidently with these conditions, we have before us the necessity of supplying gas at as low a rate as possible. With coal at an increased price of (say) 2s. 6d. a ton, it is rather more than can be expected that the increase will be recouped by the higher price of coke, as this would mean an advance of coke prices by 5s. per ton. Tar, too, is only valued in the market at (say) 1d. per gallon; and it is not going to rise in price until it finds greater use in other directions than at present. However, coke and tar are the materials used in the methane-hydrogen process of gas manufacture; and this is regarded as an important consideration (in giving profitable outlets for these residuals) by those who have interested themselves in this system of gas manufacture. In the first place, a ton of coke is used in producing 60,000 cubic feet of methane-hydrogen gas; and charging the process with an increase of 5s. per ton of coke, would only add 1d. per 1000 cubic feet to the cost of manufacture. The making of every 60,000 cubic feet of gas also absorbs 60 gallons of tar—1 gallon per 1000 cubic feet; and there is value in being able to profitably relieve a works of tar at this rate of consumption. But neglecting these advantages, the makers of the methane-hydrogen gas plant compute, on the figures that are available from actual working, that, under fair conditions, gas makers can, by the adoption of this system, reduce the average cost of gas in their holders by 2d. per 1000 cubic feet. Accepting this, it follows that the dearer coal gets, the more advantageous is it to go in for such a plant.

## The Carbon Monoxide Question.

The gas produced by the methane-hydrogen system (the subject of the preceding paragraph) contains only 2·8 per cent. of carbon dioxide, and 28·8 per cent. of carbon monoxide; and in the mixed gas at Swindon, the carbon monoxide is down to the low percentage of 8·2. In the discussion in Paris recently, as to whether coal or water gas should be adopted in extending the gas-works, the advice was given to the Municipality by the Committee of Hygiene that a mixture of coal and water gas could be accepted if it did not contain more than 10 per cent. of carbon monoxide. The resolution to adopt water gas was rejected purely on this point of carbon monoxide. The Swindon experience shows that it is possible, with the methane-hydrogen plant, to reap the advantages offered by it, and keep (using up to 20 per cent. of the gas) well within the 10 per cent. of carbon monoxide submitted as allowable by the Committee of Hygiene to the Paris Municipality.

## Gas Coal in Kent.

Since the commencement of the boring operations for coal which are being carried out at Dover by the Kent Coal Concessions, Limited, they have been watched by gas managers, especially those residing in the South of England, with considerable interest, in the hope that possibly, in the not remote future, coal would be found which would prove suitable for making gas. After much patient waiting, the hope has been realized. It will be seen from an article which appears elsewhere, that samples of coal from the Fredville and Waldershare borings have lately been submitted to Mr. George R. Hislop, of Paisley, for analysis; and he has reported favourably upon them. The Fredville coal contained, on the dry basis, 78·03 per cent. of carbon, 5·44 per cent. of hydrogen, 4·67 per cent. of oxygen, and 0·76 per cent. of sulphur; and Mr. Hislop expresses the opinion that when raised in bulk it will be "well suited alike for gas, steam-raising, and household purposes." With regard to the Waldershare coal he is rather more explicit on the point of its gas-making qualities. He characterizes one sample as "exceptionally valuable," inasmuch as it will yield approximately 13,000 cubic feet of 23·5-candle gas to the ton; while another is stated to be a "valuable coal" for gas making, as its yield is approximately 12,500 cubic feet of 22·5-candle gas per ton. These figures show the coal to be of very good quality from the gas manager's point of view; and if it should be available in any considerable quantity, it will relieve him of some anxiety as to the supply of his raw material.

## Gas Supply in Germany and Warsaw.

Owing to various causes—chief of which must be ranked the continued disturbed state of affairs in Warsaw—the German Continental Gas Company are, we regret to see, unable to maintain on the present occasion the dividend of 10 per cent. which the shareholders have now enjoyed for five years in succession. In Warsaw, the Company are accustomed to dispose of over half of their total output of gas; and in 1906 there was a decrease in the make there of 2·09 per cent., which followed on a decrease of 5·08 per cent. in 1905. The annual report, forwarded by Herr W. von Oechelhaeuser, the General Manager (which appears in this issue), will probably lead the shareholders to congratulate themselves heartily on the fact that the result is no worse. But though, under the trying circumstances, the business done cannot be regarded as unsatisfactory, there is cause for keen regret in another direction; oft-repeated labour troubles, assaults, and outrages having culminated in the assassination of Herr A. Welke, the Manager of one of the Company's works. Then, again, there has been a large amount of expense caused by the unsettled state of affairs, which has, of course, been reflected in the profits, in spite of the fact that the sales of gas did not very largely decrease at Warsaw. Fortunately, however, the German portion of the business showed an increase of 5·82 per cent., so that the net result was a gain of 1·91 per cent., compared with

an increase of 0·31 per cent. the preceding year. In consequence of the decrease in the Warsaw profits, the total profits exhibit a falling off of nearly £35,000 as compared with 1905, which, from a like cause, were smaller than those for 1904; and in addition to this, a new issue of stock has increased the amount on which dividend has to be paid. The shareholders are, however, to receive 8 per cent. on the present occasion; and there is no reason to doubt that when the Russian political horizon clears, the undertaking will rapidly return to its old position as a dividend payer. The industry itself is on as sound a basis abroad as is the case in this country.

### Gas Profits and the Rates.

Mr. Thomas Duxbury—at one time Manager of the Darwen Gas-Works, and now an active member of the Town Council—is not a man who accepts defeat easily; and he has just met with the success which is usually associated with persevering effort. Nearly twelve months ago, he moved a resolution having for its object the rescinding of a previous decision to the effect that when the gas-works reserve fund reached £5000 the profits should automatically go to the relief of the rates. On that occasion he was unsuccessful; but, strong in his knowledge that he was fighting in a good cause, he last week returned to the attack, when, to his amazement, there was no opposition to drive from the field. The question was not even put to the vote; for the whole twenty-four members were of one opinion. Apparently, the matter is not really at an end, inasmuch as Alderman Tomlinson, who was previously the leader of the opposition, remarked that in a month's time they would have another year's results before them, and they would then try to allocate the profits in the best way possible. This seems to indicate that only one stage in the struggle to free the gas consumers from the hardship of having to assist electric light consumers and other non-users, and very small users, of gas in the payment of their rates. But however that may be, a good start has been made; and we can only wish Mr. Duxbury a like amount of success in any future skirmishes there may be.

### Exhibitions.

After the Earl's Court Gas Exhibition, the electrical exhibition at Olympia. After the Manchester Gas Exhibition towards the end of next autumn, an electrical exhibition will, in all probability, succeed. That is what we gather from the annual report of the National Electrical Manufacturers' Association, upon whom "considerable pressure" is being brought to bear by the Manchester and Salford Corporations with the view to the organization of an exhibition. It may interest the Manchester District Institution of Gas Engineers to know that it is the view of the Committee of the Electrical Manufacturers' Association that considerable financial assistance will probably be accorded to the exhibition by those corporate bodies. Financial assistance for such displays is a great point with this Association, whose Committee have unanimously resolved to recommend that the decision arrived at last year not to exhibit at local exhibitions unless freed of all charges and expenses be firmly maintained. Some local authorities decline to subscribe to such purposes on the ground that they have no statutory authority for so doing. We remember hearing an old gas administrator once say that "maintenance" had an expansive meaning; and the item was always to be found in the accounts of well-ordered undertakings. *Verb. sap.* A list of the exhibitors in the Gas Section of the Dublin Exhibition (which is to be opened early next month) is published elsewhere in this issue.

### Socialistic Ambitions.

We have more faith in the intelligence of the average working men of the country than to believe that the greater proportion of them have any sympathy with the rabid schemes flaunted before their eyes by such bodies as the Independent Labour Party or the Social Democratic Federation, which have been meeting recently respectively at Derby and Carlisle. At both gatherings Socialism was preached with loud tongue; and chimerical projects leading through municipalization to impossible communism were resolved upon with the freedom born of unbalanced mental capacity. The success of labour in the first year of the present Parliament has undoubtedly completely turned the heads of some of the demagogues of the Independent Labour Party; and their ambitions now know no bounds. At the Derby Conference, they passed resolutions expressing the desirability of investing trade union accumulated funds wherever possible with municipalities, so as to facilitate an extension of municipal enterprise, and of the party introducing a Bill to secure an extension of trading power to municipalities. The trade unions have already had the leaven of Socialism dropped into their midst; but we hope that the resolutions of the more potent unions to maintain the true cause of their existence, and eschew any identification with Socialism and its illusory works, will be adhered to. It is declared to be all a myth that Progressivism and Socialism have brought greater financial burdens upon labour. Existing facts are the reply—the burdens being both direct on labour and indirect through the heavy rates and taxes borne by industry. Nor is it true that unemployment is due to private ownership; seeing that only (we think the number is) 2 millions of the almost countless army of workers in this country have employment through municipal agency. Among the many queer proposals now put forward is one with which our old friend Mr. Will Thorne, M.P., is identified. He is to introduce a Bill which is to restrict the hours of labour in all trades and industries to eight per day; and any employer who transgresses by causing a man to work more than that, is to be subject to a penalty of anything between £10 and £100. The Bill has a one-sided thoroughness; but nothing, it has been pointed out, is said in it about a penalty for the man who has a liking for working more than eight hours a day. Labour is the capital of the working man; and Socialism seeks to rob him of the right to put that capital to the best use.

### Payment of Interest Out of Capital.

It is a moot question whether the payment of interest out of capital during works construction is not altogether wrong in principle, seeing that the money so added to capital has no earning power, and is at once unrepresented by assets. Opinions, of course, vary on the point; but whatever may be individual views, Parliament ought to settle the matter once and for all, and level practice in the case of all concerns working under the general company law or under Special Acts. But in the new Companies Bill, to which reference is made elsewhere, we have a proviso which appears to be totally at variance with a notice of motion that has been given by the Lord Chairman. In the Companies Bill, it is proposed to authorize a Company, when issuing shares to defray the expenses of the construction of works or buildings or the provision of plant which cannot be made profitable for a lengthened period, to pay interest out of capital, if sanctioned by the Articles of Association or by special resolution and by the Board of Trade, for the unremunerative period, to be determined by the Board of Trade. On the other hand, we have the Lord Chairman giving notice to amend Standing Order No. 128, so as to cause to be inserted in every Railway Bill a clause prohibiting the payment of interest or dividend out of capital, except such interest as is required for money advanced by shareholders beyond the amount of the calls actually made, and except such interest (if any, and not exceeding 4 per cent.), as the Committee on a Bill may, according to the circumstances of the case, think fit to allow. While the matter is under consideration, we may as well have established something like uniformity of practice.

## PERSONAL.

In the "JOURNAL" last week, we announced the resignation by Mr. W. C. Dawson of the managership of the Arundel Gas-Works. We learn that Mr. J. J. COE, of Ambergate, has been selected as his successor.

In the "JOURNAL" for the 5th ult., we announced the retirement, as from the 30th ult., of Mr. Charles Panchen, the Secretary of the Great Yarmouth Gas Company, after 45 years of continuous service. Mr. W. J. CARPENTER, the Company's Engineer and General Manager, has been appointed his successor; and he will discharge the duties of Secretary conjointly with those appertaining to the offices he has hitherto held.

In the course of the report which the Directors of James Milne and Son, Limited, will present to the shareholders at the annual general meeting next Friday (noticed elsewhere), they announce with regret the retirement of Mr. D. MACFIE from the position of Managing-Director and Deputy-Chairman of the Company, and acknowledge with appreciation the long services he has rendered. While Mr. Macfie retires from the directorate, he retains his interest in the Company as a shareholder.

Mr. Herbert Hyde Harrison, Assoc.M.Inst.C.E., the Resident Engineer of the Liverpool Corporation Water-Works at Oswestry, has been appointed Chief Assistant to the Engineer and General Manager of the Tarapaca Water Company, of Chili.

## NOTES FROM WESTMINSTER.

BEFORE the Easter recess, there were no additional Committees selected who will have Gas Bills under consideration. The only definite engagement in which there will be special interest for us is that fixed for to-day, when the Police and Sanitary Committee, if the arrangement has not been varied, will commence to hear what has to be said both for and against the transfer of the East Hull Gas Company's property to the Corporation. The evidence given on the Company's Bill last year, it will be remembered, supplied no reason why the present owners should be despoiled by the Corporation. The interest in the Bill, apart from the question of compulsory purchase, is intensified by the suspensory clause inserted in the Company's Act last year, which clause is not to prejudge or prejudice the question of purchase in any way. It has been said in the "JOURNAL" that the very existence of the clause is a menace; and must carry some amount of influence. We shall see now how far use is made of it by the promoters of the present Bill, and how far it influences, or appears to influence, judgment. We believe that both sides have made preparation for a stiff fight.

**Hull Purchase.**

In other respects, the Gas Bills are moving along smoothly; and the prospect of discussion in either House over them, except in two or three instances, dwindles week by week. Several of the Bills have been read the third time in the House of Commons, and a batch was sent to the Lords before Easter, and was read the first time, and referrred to the Examiners. Several Committees of the Upper House have been appointed; and water measures bulk largely among those that will come before them. But their Lordships are in no violent hurry, for they do not propose to set to work on these Bills before the 23rd or the 30th of this month, which does not give them much time for a solid output before the Whitsun holidays. They take things comfortably in the Lords, although it was only the other day that there was quite an avalanche of complaint from the Upper House as to the little courtesy and consideration shown them by the Commons sending Bills to them at the eleventh hour of the session. The Lords do not set the Lower House a good example.

**Water and Minerals.**

Just before the holidays, the Committee who had been considering the Worthing Gas Bill had before them the Keswick District Council's Water Bill. The Council wanted to make their water supply not only more efficient for the needs of the district, but more secure. They are proposing the construction of new water-works at a higher level, the tendency of building in the neighbourhood being to the higher ground. The Lord of the Manor, however, considered that what it was proposed to do would, in some measure, interfere with his mineral rights; but a very strong case was made for the Bill by Mr. Honoratus Lloyd, K.C. He showed how the Lord of the Manor was protected by the compensation that the general water-works law gives him if his interests are affected; and he also appealed to the higher sentiments when he submitted that the water supply of a community ought not to be subservient to even the mineral rights of the Lord of a Manor. But in this case, the Lord of the Manor appeared to be a fairly pliant gentleman—after hearing the opening of the case for the Bill; for during the luncheon interval on the very first day of the hearing, Counsel and their clients put their heads together, and arrived at a settlement, the performance of which will not impose any great hardship on the Council. While the Lord of the Manor has to some extent made concession in the public interests, he has gained all the protection he requires, through the limitations imposed in this clause: "Notwithstanding anything in this Act contained, the Council shall not increase the diameter of any pipe by which water is now conveyed from any of the streams (the waters of which they are by this Act authorized to take or use) to the reservoirs of the Council, nor substitute any pipe of larger diameter therefor, nor increase the number of pipes by which water can be conveyed from any such stream to any of the reservoirs of the Council." The clause is perhaps a little cryptic to outsiders; but any way it is the one that produced satisfaction.

## GAS STOCK AND SHARE MARKET.

**(For Stock and Share List, see p. 111.)**

THE "long lane" of depression on the Stock Exchange has had a turning at last; but before the turn was reached, the going was anything but pleasant. The earlier portion of last week was far from promising. After a brief hesitation at the opening, the course of things ran steadily downward. The ruling tone was thoroughly bad, sales were being pressed everywhere, and another failure helped to intensify the depression. On Thursday the outlook at first was dismal enough, and liquidations still went on; but before the day closed, a remarkable revulsion took place. Brighter views prevailed, and a steady tide of buying set in; prompted apparently by the improving monetary outlook. On Friday the recovery was confirmed and matured, though business was not buoyant or voluminous. Favourable conditions ruled on Saturday, and prices were still on the rise; so that the close of the week was in marked contrast to its opening. In the Money Market, there was an abundant supply; and short loans were had on easy terms. Discount rates, too, became considerably lighter, in view of the promise of cheaper money and a possible reduction in the Bank rate at an early date. Business in the Gas Market was rather irregular—some days affording promise of activity which the next failed to maintain; so that the aggregate was much below the average. Changes of price were few and far between; but, such as they were, all (at least, in the London Market) were in the upward direction. In Gaslight and Coke issues, the ordinary was, on the whole, rather quiet, but very firm; and the limits of price within which actual transactions were marked were fractionally better than the preceding two or three weeks—viz., $95\frac{5}{8}$ to $96\frac{3}{4}$. Dealings in the secured issues were quite up to average. The maximum realized $88\frac{1}{4}$ and 89, the preference from 105 to $106\frac{1}{2}$, and the debenture from 83 to $84\frac{1}{4}$. South Metropolitan was moderately active, and was unchanged. Transactions were marked at from $120\frac{3}{4}$ to $122\frac{1}{2}$. The debenture changed hands at $85\frac{7}{8}$. Commercials were almost unnoticed—there being only one deal in the 4 per cent. at 108. The Suburban and Provincial group exhibited their usual quietude. Brentford old was done at 250 and 251, South Suburban at $121\frac{1}{4}$, and West Ham at 103. On the local Exchange, Newcastle was lower. The Continental Companies were active taken altogether, though Imperial was quiet. The quotation advanced a point, and transactions were marked at 178 and $178\frac{1}{4}$. Union was done at 121, ditto preference at 141 free, European fully-paid at from 24 to $24\frac{3}{4}$, and ditto part-paid at from 18 to $18\frac{1}{4}$. Among the undertakings of the remoter world, Bombay changed hands at $6\frac{13}{16}$ and $7\frac{1}{8}$, Buenos Ayres at $11\frac{7}{8}$, Monte Video at $11\frac{3}{8}$ and $11\frac{7}{8}$, Primitiva at from $7\frac{1}{8}$ to $7\frac{7}{8}$, ditto preference at $5\frac{1}{8}$ and $5\frac{3}{16}$, ditto debenture at from 95 to 96, River Plate at from $12\frac{7}{8}$ to $13\frac{1}{4}$, and Melbourne $4\frac{1}{2}$ per cent. at $101\frac{1}{4}$ *ex div.*

## ELECTRIC LIGHTING MEMORANDA.

**Illuminants and Fires—A Delayed Pleasure—Gas and Electricity Generated Fires in London—Installation Work—Questioning the Protective Virtues of Steel Tubing for Wiring—Municipal Incompetence in Local Management, Illustrated by Watford.**

THE sublime language in which the safety of electric lighting has been written-up has of late been reduced to the ridiculous by hard facts, which no amount of pretty diction will dissolve. As the evidence accumulates, and uncomfortable questions arise regarding electricity dangers, so the wordy outbursts of our more sedate electrical contemporaries on the dangers of gas have toned down, until now the "Electrical Review" holds out the olive-branch by saying comparative statements "do not show up gas as a fearful instrument of destruction, and, candidly, we are glad of it." We accept the confession in the spirit in which we hope and believe it was made. In the same article, we read that it is "against all inclination," but it is "necessary, to rebut not once, but many times, the charge that electricity remains a demon untamed in the hands of our brethren, and in fair play press home the invariable victory by carrying an edged *tu quoque* into the enemy's camp." The expressions in this statement are a little disappointing. They look a bit too warlike to be compatible with the declaration that this kind of thing is distasteful to inclination. But, nevertheless, we will do as little as possible to disturb the harmonious intentions of the "Review." After the sentences quoted above, our contemporary writes: "With what pleasure, then, do we read in a recent issue of the 'Journal of Electricity, Power, and Gas,' U.S.A. . . . that electricity has not played a very saturnine part in the fire statistics of Germany." It can only be regarded as a pity that the "Electrical Review" has delayed for so long deriving all the pleasure possible from the statistics referred to. They were available in the "JOURNAL OF GAS LIGHTING," published in London, Eng., as far back as Dec. 18—in good time to add to the pleasures and joys of Christmas.

Having corrected this oversight on the part of our contemporary, there are a few remarks to make (not by any means with the intention of disturbing the budding good relationships with our electrical colleagues) respecting the statistics published last week from the annual report of the Chief Officer of the London Fire Brigade, who states that 105 of the fires in the Metropolis last year were due to electricity, and 405 to gas lighting and heating. The figures taken in their nakedness look very favourable to electricity; but—and this is the only point we want to make to avoid any misconception—when adequately examined, they are extremely favourable to gas. Some of the electricity suppliers in London are a little modest, and do not make returns as to the number of consumers they possess; but from the statistics available, we put as a generous estimate the number of electricity consumers supplied by the 31 electricity undertakings in London at (using a round figure) 80,000. Within a smaller area, the three London Companies alone supply nearly 900,000 consumers, among whom there are in use upwards of 600,000 hired gas stoves and fires (saying nothing about those that are private possessions). Leaving the stoves out of consideration, and dealing only with consumers, we arrive at the fact that the electrical fires last year averaged one to (say) every 760 electricity consumers, and the gas-fires one to every 2220 gas consumers. We are here doing gas the injustice of not including those consumers who are in the suburban gas companies' areas covered by the electricity statistics as to consumers; nor do we take credit in considering the comparatively small number of fires due to gas for the 600,000 hired stoves, nor for the myriads

of points of gas use for lighting, power, and other domestic and industrial purposes in the Metropolis. It is noticed, too, what a large proportion of the fires due to gas was owing to sheer carelessness. For instance, "Curtains or window blinds coming in contact with gas-flames accounted for no less than one-fourth of the total, or 102; and other goods coming into contact with gas-lights account for another 17. Considering the number of hired gas-stoves in use in London (some 600,000) the fact that there were so few mishaps with them is good testimony to their safety. Those who want to make use of the figures, or consult them for interest, will find them on page 45 of last week's issue. Meanwhile, some concern is being exhibited as to the growth in the number of mysterious fires in London; and it will not be forgotten that the City Coroner (Dr. Waldo), at a recent fire inquiry, pointed to suspicion resting upon electric lighting wires.

And this is the condition of things after all the elaborate rules and regulations that have been drawn up for electric lighting installations! Even now, engineers are not agreed as to the lines installation work should take. Some prefer one thing, and some another; and if anything goes wrong—well, it's so easy to attribute it to defective installation, and an evasion of their pet fancies. The increase in the number of fires due to electricity installations has revived interest in steel tubing for encasing the wires. The jury at the Wood Street fire recommended that all electric light wires should be encased in steel tubing; the "Electrical Review" has been giving a West-end Electricity Supply Company a drubbing, in its best style, for refusing to supply electricity for heating at the low rates, unless all the heating circuits are run in steel tubing, and for insisting on this being done, even when wood casing has already been fitted up. On the other hand, Mr. E. T. Steinthal has been dilating on the disadvantages of steel tubing before the Manchester Branch of the Electrical Contractors' Association. Is it true that in the multitude of electrical counsellors there is wisdom? If it is, then we fail to find it in connection with this question of electrical installation.

Anyone consulting Mr. Steinthal's paper for light on the subject as to how far the West-end Electricity Company or the jury at the Wood Street fire are justified in act and opinion relative to the use of steel tubing in installations would read something to the following effect. In using steel tubing, it is not possible to see the wires after they have once been put in position, and so damage, caused by drawing in, cannot be seen. Then the tubing cannot be altered or renewed without dismantling the whole circuit. Next, the mechanical strength of the light-gauge tube is negligible, as nails can be driven through it, or can crumple it up. Then there are the chemical questions that arise, such as the rapid rusting of steel, the extremely corrosive action of the salts in plasters and cements, which render even heavy-gauge tubing as thin as paper in four or five years, and cause light-gauge tube in a year or two to become a mere film of rust, which is more harmful to the cables than the plaster itself. Then electrolytic action and danger from leakage currents add to the difficulties; as does also condensation in the pipes—the accumulations of water in horizontal runs or pockets being most detrimental to both tubing and wires, more especially at bracket or switch points. The introduction of a metal conductor along the complete path of a circuit makes the whole system more liable to total breakdown, and affords an easy path for leakage currents to stray to places where damage may ensue—we may suggest gas and water pipes as examples. Mr. W. W. Lackie, in a paper before the Glasgow Section of the Institution of Electrical Engineers a couple of years ago, recommended that, when wires were enclosed in continuous metallic sheathing, the latter must be carefully insulated from any other metal work in the building. This produces unpleasant reflections; and visions of greatly enhanced installation costs rise up. But in fairness to Mr. Steinthal, it should be stated that he does not say a satisfactory job cannot be made of a steel conduit installation, if expense is no object. Of one thing the consumer may be certain—if he wants an electrical installation that may be expected to be as perfect as an installation can be, he must spare no expense; after incurring that expense, he has no assurance that he has got what he wants, nor any assurance of immunity from trouble, the origin of which is concealed.

Local authorities trading in electricity in residential districts will not heed the warnings that have been tendered to them in the past. The Watford District Council were cautioned by an Inspector of the Local Government Board quite in the early stages of their electricity undertaking not to lay mains for the public lighting of streets that did not promise to be remunerative; the monition was repeated when the capital expenditure on electric public lighting had reached £7312; and now the capital outlay amounts to £10,276, an attempt has again been made to show the Council the folly of their ways—whether successfully is another question. An inquiry has been held—this time by Mr. H. Ross Hooper—into an application for a loan of £13,500 for electricity purposes, which sum since the inquiry opened has been reduced to £8949. The result of the present investigation is an exposure of dire administrative incompetence on the part of the Council and a callous indifference to the expenditure imposed upon the ratepayers. They have already spent about £80,000 on the electricity undertaking; and after something like seven years' working, there is still a deficit between revenue and outgoings. It is in the public lighting and in the supply of electricity to a factory, that the Council have shown the greatest ineptitude and imprudence, which should make them the laughing-stock of the whole of the ratepayers. Not only has more than £10,000 been expended in public lighting equipment of a kind—mostly double 8-candle power lamps, a smaller number of double 16-candle power lamps, and 16 flame arc lamps of 800 (?) candle power—but the electricity undertaking last year took from the ratepayers £4174 for the public lighting service; the charges being at the rate of £3 15s. for the double 8-candle lamps and £7 10s. for the double 16-candle lamps, used for about 3800 hours per annum! With such a heavy expense for lighting, it can hardly be credited that the Council have not—at all events their Electrical Engineer says he has not—considered whether the streets, from the capital expenditure to the annual cost, could not be lighted at a lower outlay by incandescent gas-lamps.

It is manifestly a new tenet of Local Authorities such as the one at Watford that they were created to run electricity undertakings, and not to look after the general well-being of their districts, which well-being includes efficiency and economy. We repeat the word "economy." The Clerk to the Council very foolishly suggested at the inquiry that, if they were not allowed to light the streets by electricity, it would do great injury to their chances of getting people to take electricity. The answer is so obvious that we are surprised that the Clerk exposed himself to it. They are doing considerable injury to the ratepayers in their vain attempt to benefit the electricity undertaking. Though the Council have given the go-by to incandescent gas lighting and have been lighting the streets by means of electricity, that fact has not made the electricity undertaking prosperous; and it is more likely than not that it is because they have been advertising, through the public lamps, the great expense of electric lighting that they have done their concern irreparable injury, and have imposed upon it a capital burden from which, now, it is likely to ever feel the effects. As the Electrical Engineer had not thought it worth while to calculate the cost of street lighting by incandescent gas-burners, the Inspector did it for him, and on the spot. A 3-feet incandescent gas-burner, giving an average light of 50 candles, would, he pointed out, used for 3800 hours per annum, consume 11,500 cubic feet of gas, which, at 2s. 8d. per 1000 cubic feet, would cost £1 10s. 8d. Adding renewals, lighting, and cleaning, the annual expense would amount to from £2 10s. to £2 15s. a year, as against £3 15s. for a 16-candle power electric lamp—16-candle power when new, and if the voltage meets the views of the lamp. The electricity undertaking before economy and efficient administration is what this disclosure seems to amount to.

But it is a question whether the Watford Council are capable of efficient administration. Here is a further illustration that raises doubt. A sub-station has been put down with an equipment which cost thousands of pounds. From this sub-station, the Council are supplying one firm with electricity at 1d. per unit; the minimum payment being £400 a year. Around this sub-station are green fields; and such occupation development as takes place thereabouts is not of kind that will demand electricity. Beyond the firm in question, there is not a single consumer for this sub-station. The firm's load-factor last year was 14·78, the costs per unit were 3·67d. without providing for depreciation or reserve, and the Council were supplying at 1d.! Is this municipal incompetence? If not, what is it?

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**Cost of Cooking by Different Methods.**—An American publication recently contained an article on the relative cost of cooking by different methods, in which the following figures were given: Electricity, 4·13 c.; coal, 3·67 c.; gas, 2 c.; gasoline, 1·24 c.; and kerosene, 1·09 c. It will thus be seen that electricity would cost nearly twice as much as gaseous fuel to do the same quantity of work.

**Use of Gas in Making Barrels.**—According to "Gas News," of the Public Service Corporation of New Jersey, an experiment is being tried by Mr. William Taylor, a cooper of that city, in the use of gas for making barrels. In the production of these articles, heat is necessary to shrink the staves, and render them easily pliable. Up to now, coal, coke, or wood has been employed in the process; but Mr. Taylor uses a specially made gas-stove, over which the barrel can be set. It can be brought into operation in any part of the workshop by attaching it to a gas outlet. It does not require any engine; and one man can easily take charge of it. It appears that Mr. Taylor, who is the first cooper to try the new method, is thoroughly satisfied with it, and has done away entirely with the stoves he formerly used.

**Waterproofing a Reservoir.**—A method of waterproofing concrete has been tried on the new 500,000-gallon reservoir of the water-works of Uxbridge (Mass.), with the result that the daily leakage has been reduced from 30,000 to 5000 gallons. A 1-inch layer of pitch and tar was spread over the bottom, and was then covered with a 2-inch layer of 1 : 2 cement mortar. This was allowed to extend up the sides—thus covering any cracks at the joining of the side walls and bottom. A test made after this treatment had been applied showed a daily leakage 8000 gallons less than that indicated by the first test. A wall of brick 2 feet high was then built around the inside of the reservoir, 1 inch space being left between the brick and the side wall. This space was filled with a special composition of tar and pitch. The wall was continued up to a height of 18 feet; the composition being poured in hot, and the whole space filled. The face of the brick wall was then given two coats of neat cement. The cost of the work was $700.

# THE DEVELOPMENT OF THE METHANE-HYDROGEN GAS SYSTEM.

## Its Installation at the Swindon Gas-Works of the G.W.R.

THE methane-hydrogen gas plant of Messrs. Biggs, Wall, and Co. has come to stay. The testimony of Professor Vivian B. Lewes and of Mr. C. B. Tully, before the Irish Association of Gas Managers, has been abundantly confirmed by two years' experience at Truro, and more recently by that at the Swindon Gas-Works of the Great Western Railway Company. What has been experienced at those places will also, no doubt, very shortly be further confirmed elsewhere. But for the time being, we have the comparatively new installation—incorporating improvements in both plant and method—at Swindon, which plant, we shall show later in the present article, is of interest from many points of view.

### THE MAIN FEATURES OF THE SYSTEM.

It will not be out of place, before specially describing the Swindon installation, to refresh the memory as to the main features of the methane-hydrogen system. The gas, it will be remembered, is produced from steam, coke, and tar in a generator similar to that of a water-gas plant, but of special construction. The object of the inventors has been to produce gas from the residuals of the manufacture of coal gas, instead of being in any way dependent on outside sources for raw material. Coke is used as the fuel; tar, as the enriching hydrocarbon in lieu of oil. This independence from the vagaries of outside markets is a very important matter, and one which will not be lightly set on one side by a gas engineer in considering the distinctive features and merits of the claimants for their favour.

Methane-hydrogen gas differs from blue water gas, in that it burns with a yellow flame instead of a blue flame; it contains considerable proportions of methane and hydrogen; and the carbon monoxide content is comparatively low. As a diluent for coal gas, the methane-hydrogen gas has developed a very good character, as it has been found to stand second to none in the facility with which it picks up hydrocarbons from crude coal gas. Of course, the quality of the tar used in the manufacture of the gas produces variations in its composition; and, naturally, the lighter and more volatile the tar, the better the gas produced.

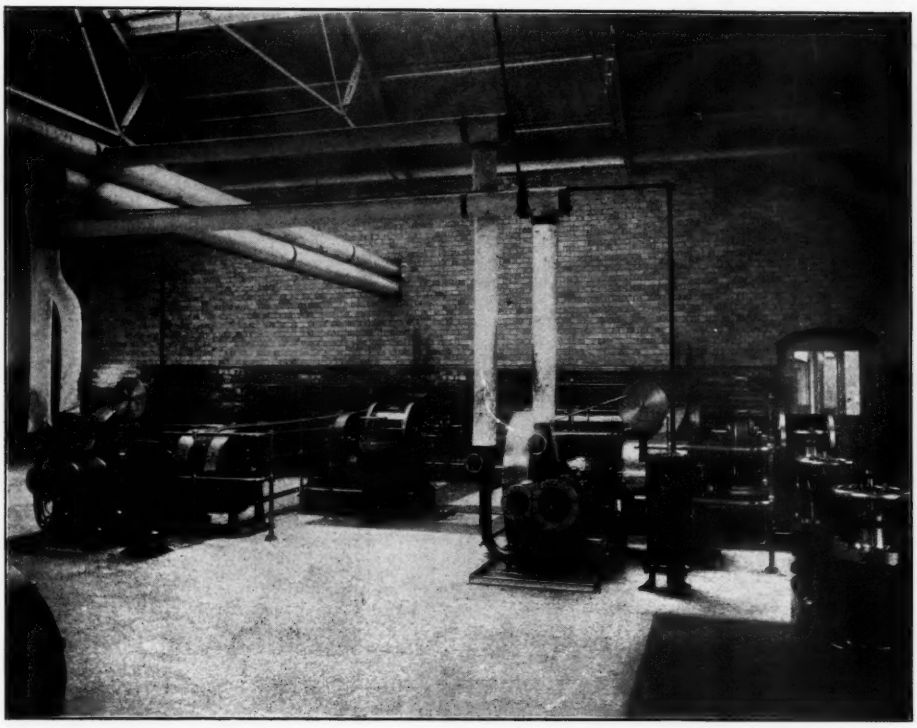


**Fig. 1.—The Methane-Hydrogen Gas Plant at the Swindon (G.W.R.) Gas-Works—The Engine-Room.**

To show the composition of the gas obtained by using a gallon of a fair average coal-gas tar in the generator, we cannot do better than reproduce the following results of an analysis:—

*Composition of Methane-Hydrogen Gas.*

| | Per Cent. |
|---|---|
| Carbon dioxide | 2·8 |
| Unsaturated hydrocarbons | 0·8 |
| Oxygen | 0·2 |
| Carbon monoxide | 28·8 |
| Methane | 19·2 |
| Hydrogen | 42·4 |
| B.Th.U. | 357 |

From these figures, the low percentages of carbon dioxide and carbon monoxide will be noted.

In considering the question of manufacturing cost, naturally much depends upon the quality and market value of the raw materials, and the size of the plant used. From the figures before us, it is calculated that, with coke at 15s. per ton, and tar at 1d. per gallon, the producing costs are about 7d. per 1000 cubic feet in the holder. And the gas so made at that cost can be used up to 50 per cent. by employing benzol to increase the illuminating power, or up to 20 per cent. with good coal gas without any further enrichment than that which the gas picks up from the crude coal gas tars. The system, in short, is one which, in addition to creating a market for two residuals, contributes to economy in gas production; and, in these times of high-priced coal and the demand for cheap gas, it makes one pause to read the claim of the makers of the plant that, by the use of the system, a saving of at least 2d. per 1000 cubic feet can be made on the whole of the gas production of a gas undertaking.

### CONFIRMATORY FIGURES FROM TRURO.

Confirmatory of the makers' figure of 7d. per 1000 cubic feet (working under constant conditions) are the details of costs that Mr. S. J. Ingram, of Truro, has furnished, concerning his intermittent working during the half year ending Dec. 31 last. The results Mr. Ingram regards as very satisfactory; but there is no doubt they would have been very much better had he been in a position to work the plant more regularly than, through his particular circumstances, he is able to do at present. The plant is operated by day only; lying idle at night, on Saturday afternoons, and on Sundays. In fact, taking the past half year through, it was at work only a quarter of the time. In order to show what could be done in a continuous 24 hours' run, Mr. Ingram had a trial during last summer, when the cost came down to just under 8d. per 1000 cubic feet.

The following are the particulars referred to, as to the

*Working of the Methane-Hydrogen Plant at Truro* (966½ *Hours only*) *during the Half Year ending December*, 1906.

| | Cubic Feet. |
|---|---|
| Total gas (coal and methane-hydrogen) made | 26,694,300 |
| Methane-hydrogen gas made | 5,568,500 |
| (Percentage of the methane-hydrogen gas to total, 20·86.) | |

| Costs— | Per 1000 C.F. |
|---|---|
| Generator fuel | 4·30d. |
| Wages of operator | 1·20 |
| Steam supply | 2·06 |
| Tar (¼ gallon) | 0·58 |
| Enrichment | 0·84 |
| Total cost | 8·98d. |

In these costs, the coke for the generator has been calculated at 15s. per ton. It will also be noted that Mr. Ingham has succeeded in bringing down the cost of enrichment to 0·84d. per 1000 cubic feet of the methane-hydrogen gas made. In considering the total cost, the intermittent and short-time working to which allusion was made in introducing the figures must be borne in mind. At Swindon, it will be seen later in this article, they are working at a lower cost, notwithstanding that a gallon of tar is being used per 1000 cubic feet of gas produced.

### The Method of Operation.

As we are leading up to the description of the latest installed plant and still more recent improvements in the generator, the cycle of operations may also be generally described. The generator, having been charged with fuel, is ignited, and blown up to a high degree of incandescence by an air-blast through openings left at the lower part of the generator. The products escape through the nostrils half-way up the generator into the stack-pipe, and away into the air through the snift-valve. In this way, the fuel is raised to a high state of incandescence for a definite height; and with proper regulation of the air-blast, the escaping products will contain but little unburned matter. The fuel in the upper part of the generator is only heated to a comparatively moderate degree. The necessary temperature having been attained, by means of the working lever a run is commenced, the exhauster is started, the blast and snift-valve automatically closes, and tar or other heavy hydrocarbon is injected into the annular spaces or pockets below the projecting ring, and in the incandescent fuel decomposition of the hydrocarbon takes place. In other words, the tar is broken up into carbon and gaseous products. Simultaneously with this action, steam is injected at the bottom of the generator; and this, playing upon the clinker formed during the blow, breaks it up, while the steam is converted into water gas. The various gases formed during this portion of the process pass upwards, together with the finely-divided carbon from the decomposition of the tar, which carbon is filtered from the gas by the comparatively cool part of

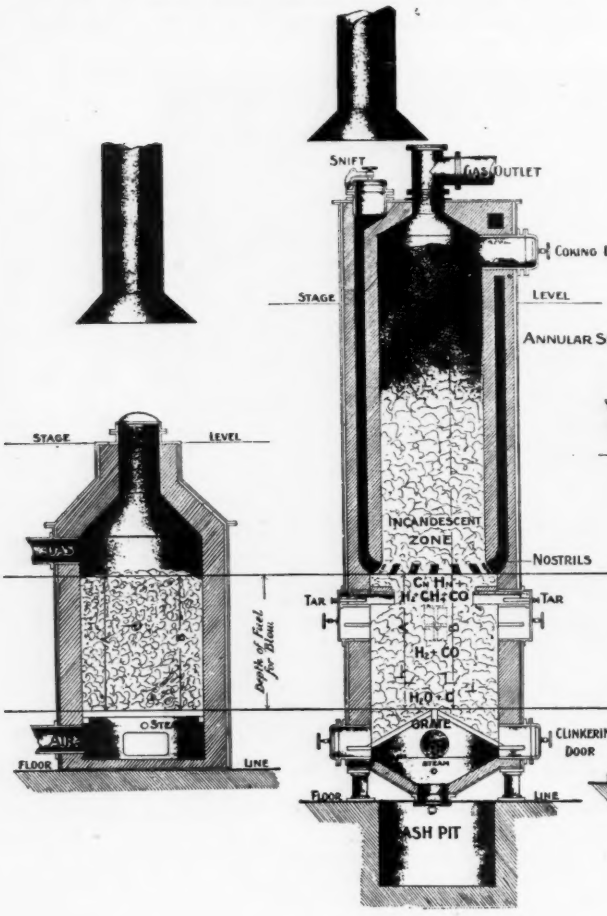



Fig. 2.—Blue Water-Gas Generator, Methane-Hydrogen Generator, and Carburetted Water-Gas Generator, showing the Respective Depths of the Blast Fuel during the Blow for Gas-Making Purposes.

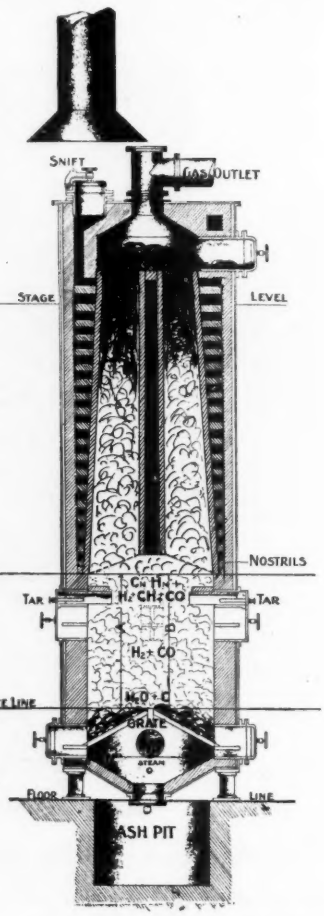



Fig. 3.—The Latest Improvement in the Methane-Hydrogen Gas Generator, showing the Vertical Columns of Fuel, and the "Regenerative" Chequer Brickwork.

the charge in the upper portion of the generator. As the fuel gradually sinks, it is brought down into the zone of combustion below the nostrils, and, on account of its fine state of division, is utilized, in the actions which take place, before the larger masses of fuel. The mixture of hydrogen, carbon monoxide, and methane formed in the second period of action leaves the generator near the top. This describes the cycle of operations in the generator. How the gas is treated subsequently will be explained in dealing with the Swindon plant.

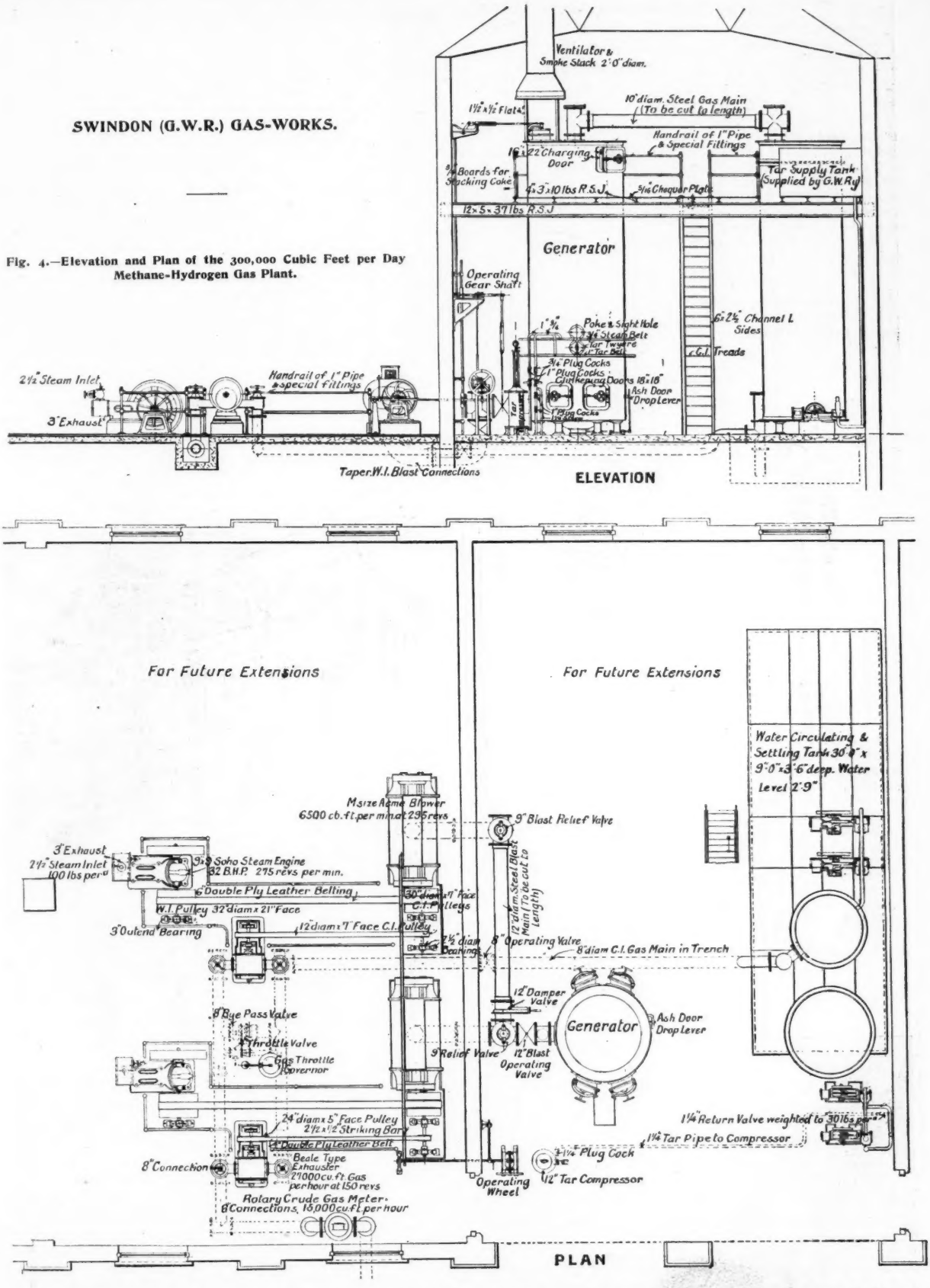
Before leaving the generator, however, it may be mentioned that, among its features to which the makers of the plant attach great importance are these: (1) The incandescent zone of fuel is maintained at the same height, resulting in a uniform quality of gas; also the heating up of the upper bed of fuel above the nostrils by means of the waste gases, which saves fuel. (2) The heat of the lower bed of fuel during gas making is partly recovered, and stored up in the upper bed of fuel. The importance of this will be apparent to engineers experienced in producing gas by means of generators.

### THE INSTALLATION OF THE PLANT AT SWINDON.

There are comparatively few gas engineers who know the works that the Great Western Railway Company have in existence at Swindon for the service of gas to their extensive establishment there, embracing the magnificent locomotive, carriage, and other workshops. The gas-works (of which, as is well known, Mr. E. C. Riley, J.P., is Engineer and Manager) produce about 300 million cubic feet of gas a year, or over 1 million cubic feet a day during winter; and this gas is used for multifarious purposes, including the driving of gas-engines for generating electricity, the lighting and heating of the locomotive and other workshops, core drying, &c., &c. To supplement his manufacturing capacity, and to give him the power of quick emergency production, Mr. Riley has adopted a methane-hydrogen plant, having a capacity of 300,000 cubic feet a day, or, if pressed, 350,000 cubic feet. This plant is a development on that at the Truro gas-works; and it has had in its design the benefit of the experience there. Nevertheless, the plant at Truro, as has been shown by Mr. Ingham's latest report (previously alluded to), has given a good account of itself,

## SWINDON (G.W.R.) GAS-WORKS.

Fig. 4.—Elevation and Plan of the 300,000 Cubic Feet per Day Methane-Hydrogen Gas Plant.


Ventilator & Smoke Stack 2'0" diam.
10" diam. Steel Gas Main (To be cut to length)
1½"x½" Flat
Handrail of 1" Pipe & Special Fittings
16"x22" Charging Door
Tar Supply Tank (Supplied by G.W.Ry)
Boards for Stacking Coke
4-3"x10lbs R.S.J.
¾" Chequer Plate
12"x5"x31lbs R.S.J.
Generator
Operating Gear Shaft
1" Poke & Sight Hole
Steam Belt
Tar Twyfre
Tar Belt
¾" Plug Cocks
1" Plug Cocks
Clinkering Doors 18"x18"
Ash Door Drop Lever
Plug Cocks
6"x2½" Channel L Sides
C.I. Treads
2½" Steam Inlet
3" Exhaust
Handrail of 1" Pipe & special fittings
Taper W.I. Blast Connections
ELEVATION
For Future Extensions
For Future Extensions
Water Circulating & Settling Tank 30'0" x 9'0" x 3'6" deep. Water Level 2'9"
M size Roots Blower 6500 cb. ft. per min. at 295 revs.
9" Blast Relief Valve
3" Exhaust
2½" Steam Inlet 100 lbs per"
9" Soho Steam Engine 32 B.H.P. 275 revs per min.
6" Double Ply Leather Belting
30" diam x 11" Face C.I. Pulleys
W.I. Pulley 32" diam x 21" Face
3" Outend Bearing
12" diam x 7" Face C.I. Pulley
2½" diam Bearings
12" diam. Steel Blast Main (To be cut to length)
8" Operating Valve
8" diam C.I. Gas Main in Trench
12" Damper Valve
8" Bye Pass Valve
Generator
Ash Door Drop Lever
4" Throttle Valve
Gas Throttle Governor
9" Relief Valve
12" Blast Operating Valve
24" diam x 5" Face Pulley
2½"x½" Striking Bar
4" Double Ply Leather Belt
1¼" Return Valve weighted to 30 lbs per
1¼" Tar Pipe to Compressor
8" Connection
Beale Type Exhauster 21000 cu. ft. Gas per hour at 150 revs
1¼" Plug Cock
Operating Wheel
½" Tar Compressor
Rotary Crude Gas Meter. 8 Connections, 16,000 cu. ft. per hour
PLAN

and has rendered excellent service. At Truro, the plant had to be fitted into the existing buildings; and this had a somewhat cramping and hampering effect. On the contrary, at Swindon, the house was built for the plant, which, of course, gave the designers and contractors every opportunity of making an excellent job of it. The Great Western Railway Company and their Engineer believe in doing things thoroughly; it being a principle with them that work well done in the first instance is more economical in the long-run. No expense within reason was therefore spared in putting down the system; and, looking at the plant generally, it will, we venture to say, bear comparison with its competitors.

After the explanation already given as to the method of operation, supplemented by the illustrations that accompany this article, we do not think that the plant at Swindon requires anything more than the most general description.

In one of the illustrations (fig. 2), are shown three types of generators—on the left-hand side a blue water-gas generator, on the right-hand side a carburetted water-gas generator, and in the centre a methane-hydrogen generator—which illustrate the respective depths of the blast fuel during the blow for gas-making purposes. These drawings will explain themselves. It may, however, be mentioned that the methane-hydrogen generator differs

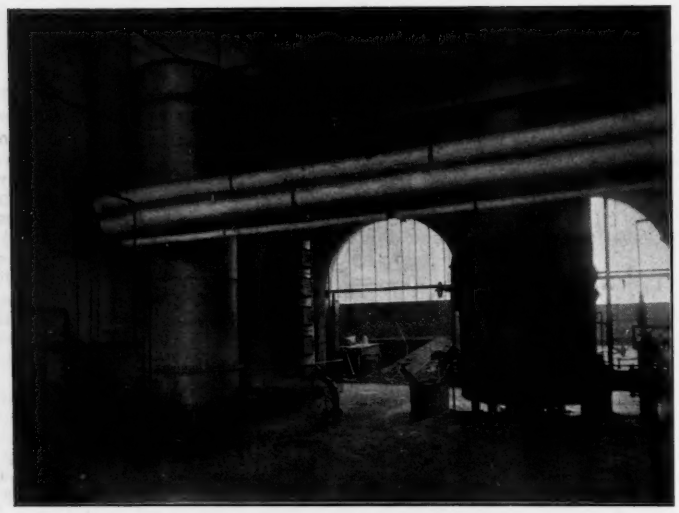


Fig. 5.—A Full View of the Generating Plant.

from a water-gas generator, in that during the production of gas, the gas has to travel through about 10 feet of incandescent fuel. Regarding this depth of fuel bed, the point that Messrs. Biggs, Wall, and Co. submit is this: That in ordinary blue water-gas plants using a shallow bed of fuel, it is true that they are able to blow to complete combustion. But whereas the shallow bed of fuel is economical for blowing, it is not advantageous for gas making. The firm therefore contend that what is wanted is a shallow bed of fuel for blowing, and a deep bed for gas-making, and this condition they have secured in the methane-hydrogen gas generator by the construction and method of working. Furthermore, they point out that the hot gases going away with the blast in the ordinary generator are blown into the air and wasted; with the methane-hydrogen generator, they are utilized to heat up the upper mass of fuel. Again, during gas-making, instead of the hot gases passing away out of the generator, the heat of the gas is retained in the upper bed of fuel; thus effecting considerable economy in fuel consumption.

The central generator depicted in the illustration to which we have been referring is the type that has been installed at Swindon. It is 20 feet high, and 7 feet in diameter, and holds about 4 tons of fuel. Among the differences between this improved generator and the one at Truro is noted its fitting with a hip grate, which brings the blast and steam into the centre of the generator, and leaves a certain amount of fuel in the wings at the bottom, which is easily re-kindled when blowing. Other improvements are found in the tar-doors and tar-box, which enable tar to be injected into the body of the mass of fuel. The amount of the air-blast, too, is about doubled by the provision of larger blowers, which are of the Roots type. The blowers, by the way, are provided with 25-horse power engines. The engines, however, are only running when required; being absolutely stopped when they are not doing serviceable duty. This, again, tends to economy. The generator has only to be clinkered once every twelve hours; this being done by inserting loose bars through the fire-doors, and so supporting the fuel above—the clinkers in this way being readily removed. The labour involved is very light. The whole operation of clinkering, charging the generator with coke, and oiling the engines and machinery, are done by two men in one hour out of every twelve hours. These two men operate the whole of the plant, including the work attending the production of steam.

### The Latest Improvement in the Generator.

While on the subject of the generator, there has been a further development since the construction of the Swindon plant; and this development is being incorporated in a plant that is being erected for a large Provincial Gas Company. The object of the fresh improvement is the further conservation and utilization of the heat. The development is illustrated in fig. 3. In this case, the bed of fuel above the nostrils is divided into four columns, or we might almost say the upper part of the generator consists of four retorts, between which chequer brickwork is packed to retain or store the heat from the blast gases. The heat so stored in this chequer brickwork round the retorts will further tend to economize the fuel and reduce the amount of the carbonic acid in the gas, which even with the present working type of generator is extremely low—2·8 per cent. This generator is a step in advance—the same as regenerative gaseous firing was upon the primitive direct-fired setting.

### The Auxiliary Plant at Swindon.

After this little digression to show that the Swindon generator does not represent the last word on the development of the methane-hydrogen system, we return to the Swindon installation, and briefly follow the course of the gas through the remaining plant. After leaving the generator, the gas passes into the hydraulic seal immediately above the scrubber. Thence it travels down through a central pipe in the scrubber, and up again through trays filled with coke. The gas flows out from the top of the scrubber into the condenser; the gas being passed through the tubes, which practice is found to facilitate the cleaning out of the tubes at any time. The gas is then dealt with by the exhauster, and is carried forward to the holder, which is a small previously existing one that has been allocated to the methane-hydrogen gas—its capacity being some 100,000 cubic feet. A few words more as to the character of the plant just mentioned. The scrubber is 6 feet in diameter, and 18 feet high. The condenser is of the ordinary water-cooled tubular type, 5 feet in diameter by 16 feet high. The pair of exhausters have each a capacity of 20,000 cubic feet per hour. All the machinery has been provided in duplicate.

With reference to the water-circulating arrangements, Messrs. Joseph Evans and Sons' "Reliable" water-circulating pumps (with 3-inch suction and delivery pipes) have been adopted. The water tank is located under the scrubber and condenser, and is about 20 ft. by 10 ft. by 6 ft. deep, covered with chequer plates. The water is pumped through the condenser, and thence to the scrubber—the gas being maintained at a temperature of about 80° Fahr. The water in the tank has only to be renewed about once a month. It contains no tarry matter; but in about a month it gets fairly well charged with sulphuretted hydrogen, and then it is advisable to empty and refill the tank.

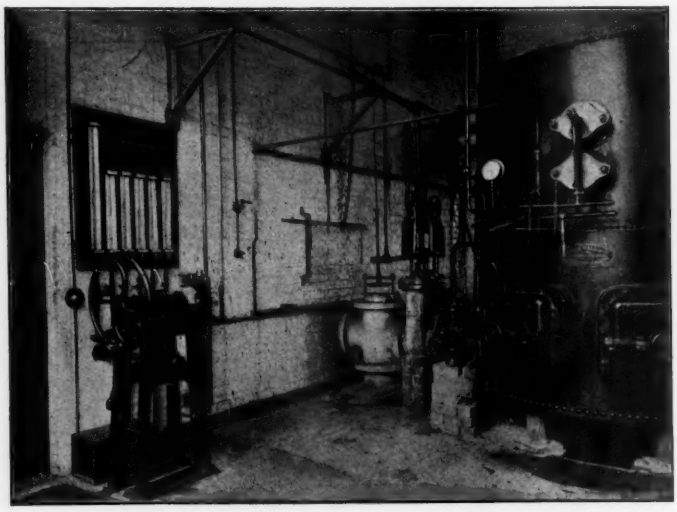


Fig. 6.—Operating Gear, Showing the Relief and Blast Valves.

Fig. 7.—Another View of the Operating Floor and Gearing.

### Simplicity and Economy.

We have described what has been done to effect economy in the working of this methane-hydrogen plant, and have also called attention to the small amount of labour involved. The simplicity of operation is another point; for the whole of the valves and everything is manipulated by one operating-wheel. The satisfactory statement is made that there has been no explosion, no stoppages in the washer, scrubber, or condenser, or bother of any kind during the nine months' working at Swindon; and the same may be said of the Truro plant after two years' experience. So far as the condenser is concerned, there has been no accumulations there, but what could be washed out by a hose; there being no pitch or anything of that nature to deal with.

Since the plant started at Swindon, it has been running on two-minute blows, and ten-minute runs; and the carbonic acid in the gas has not exceeded at any time 2·8 per cent. The generator is coked-up every two hours, and clinkering is done every twelve hours—that is to say, it is actually working eleven hours out of the twelve, or 22 hours per day, which is a high rate of efficiency in running.

### How the Gas is Finally Dealt with, and the Result.

The course of the gas has been followed to the holder specially set apart for its storage; and now the mixing with the coal gas and the result have to be referred to. From its holder, the gas passes through a station meter into a main on the top of the retort-bench, and is there heated up to about 200° Fahr. before mixing with the coal gas. Without this preliminary heating, there would not be much benefit, because it is part of the system of methane-hydrogen gas manufacture that the gas should partly pick up its enrichment from the coal-gas tars, and this it can only do in a heated condition. The average illuminating power of the coal gas at Swindon is 13½ candles; and to the bulk of the coal gas is added about 22 per cent. of the methane-hydrogen gas; the total gas being then enriched to 14½ candles. The hydrocarbon used for this purpose is a residual of the Railway Company's oil-gas plant—the plant used for making oil gas for the lighting of railway carriages; and this residual hydrocarbon has an enrichment value of 28·2 candles per gallon, when used with methane-hydrogen gas. The calorific value of the coal gas before its admixture with the methane-hydrogen gas is about 600 B.Th.U.; that of the mixed gas, about 575 B.Th.U.

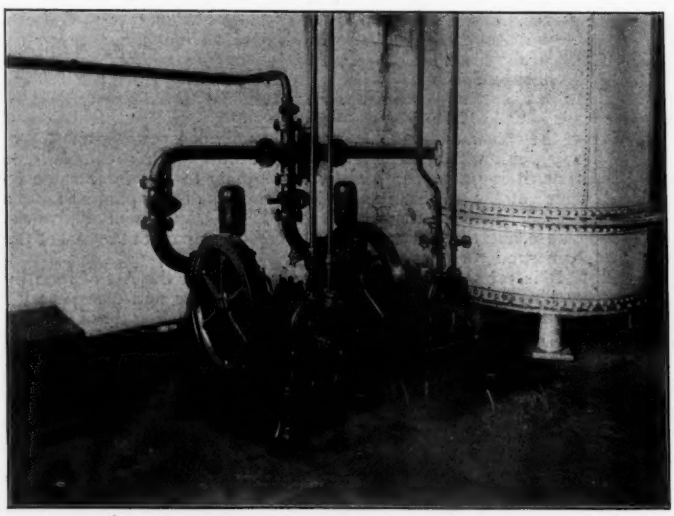


**Fig. 8.—Evans's Water-Circulating Pumps.**

The cost of the coal-gas at Swindon is approximately 1s. in the holder; but the railway facilities of the Company must be remembered in this connection. The methane-hydrogen gas, including enrichment, for the two months ending Jan. 15 last, cost them 8·1d. per 1000 cubic feet—that was on a make of about 6 million cubic feet. The consumption of coke in the generator per 1000 cubic feet of gas made was, on a trial run of twelve hours, 45 lbs.; and of coal gas tar, 1 gallon.

In these days when cheap gas is required, and yet coal is dear, a system of gas making in which two of the residuals of coal-gas manufacture are utilized, and in which the resultant gas shows such comparatively low percentages of carbonic acid and carbon monoxide, will undoubtedly receive due consideration.

## SMALL LOCOMOTIVES IN GAS-WORKS.

[Communicated.]

So many methods may be used for the economical conveyance of coal, coke, and other materials in gas-works, that it becomes an ever increasing difficulty to decide as to the particular method to employ. In small works the barrow and shovel are almost exclusively used; and it is a method of conveyance which has many points in its favour where the material to be moved is limited in quantity. For the larger works, and especially where they cover a great area, the small locomotive may be strongly recommended, and merits its adoption in many works where horse traction alone is used at present. The small locomotive running on a 3-feet gauge will haul a five or six times heavier load than is within the power of a horse, and at a much higher speed. As each method requires a man in attendance, it is not too much to state that the engine, in most cases, enables one man to do at least fifteen times more work than if he were driving a cart.

Of course, the economy to be gained by using a locomotive in place of horse traction would vary greatly according to circumstances. In many cases where the distance was great and the road straight, the economy would be much greater, and, again, where the distance was short and the road was rendered difficult by several curves and gradients, it might be almost as economical to use carts. Then, too, it must be remembered that, with manual labour, it is cheaper to load trucks than carts; for the extra two or three feet in height of the latter adds no small expense to the cost of loading. In this article, however, the writer does not intend to compare the relative advantages of different systems of conveyance, but rather to point out the advantages, and give a few details of the working of small locomotives for use in gas-works. In most large works there is plenty of scope for the economical working of these engines; and nowadays so much machinery is used, and a fully equipped fitting shop is so essential, that the necessary repairs of one or two locomotives are easily and cheaply carried out.

At the works of which the writer has experience, several small locomotives are constantly in use. A considerable quantity of the coal that is stored on the works is conveyed from the stores to the retort-houses by locomotives; and, similarly, all the coke, clinker, and ashes are removed in trucks by the same means. In the latter case, a stiff gradient, having a maximum rise of 1 foot in 12 feet, and amounting in all to about 13 feet for a distance of some 200 feet, has to be negotiated. The boilers are also entirely fed by breeze carried in trucks drawn by locomotives, which also convey the sulphate of ammonia to the wharf for loading. Indeed, there is no limit to the use that can be made of these useful little engines, provided that the rails are laid judiciously. The best locomotive of which the writer has had experience cost something under £450, and is capable of excellent work in a gas-works. The engine runs on a 3-feet gauge, and, having a wheel-base of only 3 ft. 3 in., it is able to negotiate the sharpest of curves, and has no difficulty in travelling round 29 feet radius. But in such cases as this, a check rail should be provided.

The engine is fitted with two tanks of a total capacity of 120 gallons; while the bunker holds 3 cwt. of fuel. This storage capacity, both for fuel and water, is sufficient for a hard day's work, as the locomotive consumes, on an average, rather under 2 cwt. of good gas coal and about 120 gallons of water in a day of nine hours, evaporating about 65 gallons of water per pound of coal. The working pressure is 150 lbs., and the engine is provided with two cylinders, 7 inches diameter 10 inches stroke; so that it will be seen that plenty of power is at hand for hauling a heavy load.

It should be mentioned that it takes at least two hours to get up steam, and it is therefore advisable to arrange for the fire to be lighted some time before the day's work commences. This particular engine has no difficulty in hauling five trucks of coke weighing in all about 8 tons up the above-mentioned incline; on level roads it would be well suited for hauling about double this load. The speed at which the locomotive could safely travel would, of course, vary according to circumstances; but it is distinctly advisable to run at a slow speed round sharp curves, as nothing increases the wear and tear so much as the disregard of this precaution. Coke may be burnt in the furnace, if desired, and also a mixture of coal and coke; but there does not appear to be any advantage gained by using this fuel in place of coal. More steam blast is needed for burning coke; and it is probable that the wear and tear would be increased in consequence.

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The annual return relating to our coal exports was issued as a parliamentary paper on Saturday. It gives full statistical particulars for the year 1906, side by side with those for 1905, of the export of coal from each port in the United Kingdom to each country abroad, together with summary statements showing the export of coal in every period of three months from the principal districts of the United Kingdom to the principal groups of foreign countries, and also the quantity of coal shipped at each port of the United Kingdom for ships' use on foreign voyages. The coal exported last year amounted to 55,599,771 tons; being an increase, as compared with 1905, of 8,123,064 tons, which is at the rate of just over 17 per cent. The quantity of coal sent out for ships' use on foreign voyages amounted to 18,590,213 tons—an increase of 1,194,067 tons, or at the rate of 6·86 per cent.

# THE IRISH INTERNATIONAL EXHIBITION.

### List of the Gas Exhibitors.

On May 4, the Irish International Exhibition in Dublin will be opened by the Lord Lieutenant of Ireland; and the preparations for ensuring completeness by that day are proceeding apace. The exhibition will cover some 52 acres of ground; and the exhibits will be devoted to the entire range of art and commerce, with an endless round of amusement to diversify the pleasures of the visitor. The guarantee fund it is stated now exceeds £155,000. The exhibitors in the Gas Section are:

Alliance and Dublin Consumers' Gas Company
Anderson and Duffield, Ltd.
George Bray and Co.
Clayton, Son, and Co.
Consolidated Petroleum Company, Ltd.
W. Curtis and Son
Samuel Cutler and Sons
Drakes Limited
Falk, Stadelmann, and Co., Ltd.
George Glover and Co., Ltd.
Graham, Morton, and Co.
W. C. Holmes and Co.
Irish Meter Company
James Keith and Blackman Company, Ltd.
Mobberley and Perry
Moffats Limited
Richmond Gas Stove and Meter Company, Ltd.
Stewarts and Lloyds, Ltd.
William Sugg and Co., Ltd.
United Chemical Works, Ltd.
Welsbach Incandescent Gas-Light Company, Ltd.
John Wright and Co., Ltd.

We understand there is still a small amount of space to be let in the section; and any firm desiring to occupy it had better communicate at once with Mr. Francis T. Cotton, at the Offices of the Alliance and Dublin Consumers' Gas Company.

### The Road-Tarring Competitions.

Seventeen entries have been received in connection with the above—eight for tar-spreading machines, and nine for preparations of tar. The following are the competitors for machines: Taropra, Limited (three machines); Mr. Thomas Aitken; Emulsifix Limited; Johnston's Lassailly Patent Road Binder Company; Tarmaciser Limited; and Messrs. Thwaite and Thorp. Preparations of tar have been sent by the following competitors: Mr. A. I. Craig (two samples); Messrs. R. S. Clare and Co.; Ermenite Limited; the Gaslight and Coke Company; Hahnite Limited; Kay Bros., Limited; Mr. T. G. Marriott; and the Tar Patents Solidifying and Distilling Company, Limited. At a preliminary meeting held by the Judges' Committee, it was provisionally decided that the experiments contemplated by the Roads Improvement Association should be carried out in the vicinity of London about the middle of next month. As bearing upon the subject of road-surfacing, it may be mentioned that a conference is to be held at Olympia, on the 19th inst., in the Surveyors' Section of the International Building Trades Exhibition. Among the papers to be discussed are the following: "The Use of Tar in Road Construction," by Mr. A. Dryland, Assoc.M. Inst.C.E., the County Surveyor of Wilts; and "The Planning of Roads for New Traffic," by Mr. Rees Jeffreys, the Hon. Secretary of the Roads Improvement Association, who is one of the Secretaries of the Conference.

We have received from Messrs. Stevens and Sons, Limited, a pamphlet by Mr. Ernest Lunge, Barrister-at-Law, and Mr. Bernard Dukes, Patent Agent, entitled "Critical Notes on the Patents and Designs Bill" introduced by the President of the Board of Trade (Mr. Lloyd-George) just before the Easter recess. The authors reprint the Bill, and place their critical observations immediately under the clauses dealt with. They acknowledge that their notes are technical, and that some of the opinions expressed are open to controversy. But they felt it to be their duty to cover the whole ground in detail, and to pin themselves down to particulars, if they hoped to substantiate general statements which might otherwise be open to the charge of exaggeration. The Bill, which is dealt with in our Editorial columns to-day, will come in for some sharp criticism as it goes through the two Houses; and to those who are specially affected by it, the pamphlet under notice will be very helpful.

In the course of a lecture recently delivered at the Royal Institution by Professor Lunge, on "Problems of Applied Chemistry," he remarked that occasionally even eminent practical men threw away much time and capital on inventions which turned out to be failures; but in some cases they were right in principle, and merely failed through some side issue. This happened, for instance, in the problem for recovering the sulphur from soda waste, which Gossage attacked on the right path as early as 1837, but which was only solved (after partial successes obtained by Mond and by Schaffner) half-a-century later by Claus and by Chance. At that period of English ascendency in the domain of chemical industries, many German chemists turned to this country and spent many years here; among them being the founders of some of the greatest chemical establishments in Germany, the intense development of chemical industry in which country was certainly due to the interaction of science and practical life—the former being previously too exclusively dominant there.

# THE COMPANIES ACTS AMENDMENT.

### The Government Bill.

In a previous issue of the "Journal," reference was made to the Bill introduced by Lord Granard, representing the Government, to amend the Companies Acts, 1862 to 1900. The Bill, as already mentioned, is founded on the recommendations of the Departmental Committee appointed by the Board of Trade in 1905, who presented their report in June last year. The principle underlying its main provisions is, in the words of the "Memorandum" attached to it, "the affording of information, to all who may seek for it, concerning companies registered under the Companies Acts." In the first place, the Bill will enlarge the requirements of the last of the Acts named (that passed in 1900), under which any prospectus issued must disclose certain material facts which would be calculated to influence the minds of intending investors. It has been found that promoters and others, in order to avoid this disclosure, have launched companies and sold shares on the Stock Exchange without the issue of a prospectus. It is now proposed to make it necessary for every public company not issuing a prospectus to file with the Registrar a statement containing all the facts which, under the above-named Act, are required to be disclosed in a prospectus. This requirement occupies the foremost place in the Bill; and the first schedule consists of the form in which the particulars are to be presented. The first six clauses deal with the prospectus, the allotment of shares and debentures, and the issue of certificates; the second clause containing a number of amendments of the Act of 1900. Clauses 7 to 9 deal with the issue of shares at a discount and the payment of commissions; and clause 10 gives a company power to pay interest out of capital in certain cases. Where any shares are issued for the purpose of raising money to defray the expenses of the construction of any works or buildings, or the provision of any plant which cannot be made profitable for a considerable time, it is proposed to allow a company to pay interest on so much of the share capital as is for the time being paid up for the period, subject to the conditions and restrictions mentioned in the clause, and they may charge it to capital as part of the cost of the construction of the works.

It is proposed to extend the provisions of the Act of 1900 by making it necessary to register all mortgages and charges with the Registrar of Joint Stock Companies, including those relating to landed property and book debts. This matter is dealt with in clause 11. Another object of the Bill, as previously pointed out, is to remove doubts as to the validity of perpetual debentures and debenture stock; to enable a company to give to a mortgagee an option of purchase of their debentures; and to keep alive and re-issue debentures which have been redeemed. These matters form the subject of clauses 15 to 17. The last clause is of sufficient importance, in view of recent legal decisions, to justify its reproduction:

(1) Where, either before or after the passing of this Act, a company has redeemed any debentures previously issued, the company, unless the Articles of Association of the company or the conditions of issue otherwise provide, or unless the debentures have been redeemed in pursuance of any obligation on the company so to do, shall have power, and shall be deemed always to have had power, to keep the debentures alive for the purposes of re-issue; and where a company has purported to exercise such a power, the company shall have power, and shall be deemed always to have had power, to re-issue the debentures either by re-issuing the same debentures or by issuing other debentures in their place, and upon such a re-issue the person entitled to the debentures shall have, and shall be deemed always to have had, the same rights and priorities as if the debentures had not previously been issued: Provided that nothing in this section shall prejudice the operation of any judgment or order of a Court of Competent Jurisdiction pronounced or made before the seventh day of March, one thousand nine hundred and seven, as between the parties to the proceedings in which the judgment was pronounced or the order made; and any appeal from any such judgment or order shall be decided as if this Act had not been passed.

(2) Where, with the object of keeping debentures alive for the purpose of re-issue, they have been transferred to a nominee of the company, a transfer from that nominee shall be deemed to be a re-issue for the purposes of this section.

(3) Where a company has deposited any of its debentures to secure a current account, the debentures shall not be deemed to have been redeemed by reason only of the current account having, while the debentures were so deposited, been in credit.

The other provisions of the Bill may be summarized as follows: To require every company to file annually with the Registrar a statement of their affairs in the form of a balance-sheet, and containing a summary of the capital, liabilities, and assets, but the balance-sheet need not contain a statement of profit and loss; to give power to the Court to grant relief to directors in cases where a breach of duty has been caused by honest oversight, inadvertence, or error of judgment; and to require every foreign company who establish a place of business within the United Kingdom, to file with the Registrar a copy of their charter or statutes and a list of the directors, together with the names and addresses of some one or more persons resident in the United Kingdom authorized to accept service of any notices required to be served on the company, and to file annually with the Registrar such a statement of their affairs in the form of a balance-sheet as is required of companies established in the United Kingdom.

# EXTRACTION OF AMMONIA FROM GASES.

### The Feld Process.

A FRENCH patent has been taken out by Herr Walther Feld, of Hönningen-on-the-Rhine, for a process for extracting the ammonia contained in gas resulting from the distillation of coal, and for the subsequent regeneration of the material employed. Application has been made by Herr Feld for an English patent for the same object, as notified in the "JOURNAL" for the 28th of August last; but the specification has not yet been published. Some idea of the scope of the invention may, however, be formed from the following translation of the French specification.

In the process for extracting the ammonia contained in retort and other gases by means of a solution of salts, the ammonia is fixed by the carbonic acid contained in the gases; and a carbonate of the base in the extracting salt and the corresponding ammoniacal salt are formed. Employment of a salt of an alkali metal as the extracting or washing medium has the disadvantage of producing, simultaneously with the alkali carbonate, a sulphide, under the action of the sulphuretted hydrogen which nearly always exists in gases. During the regeneration of the washing salt by distillation, there is consequently obtained impure ammonia, containing sulphuretted hydrogen. On the other hand, by employing as the washing medium a salt of an alkaline earth metal, an insoluble alkaline earth carbonate and a soluble ammoniacal salt are formed. The regeneration of the washing salt in this liquor is, however, a very long process, owing to the slowness with which the alkaline earth carbonates decompose the ammoniacal salts. Salts of magnesia do not possess any of these drawbacks, and therefore give the best results as washing materials.

According to the proportion of ammonia and carbonic acid in the gas, a sludge is formed containing a solution of an ammoniacal salt and a precipitate of bicarbonate, monocarbonate, or basic carbonate of magnesium. This sludge has the troublesome property of frequently coagulating in the form of a stiff paste, especially when the gases are washed with concentrated solutions of a salt of magnesium. This coagulation often obstructs the washers to such an extent as to stop their action. The same inconvenience arises if the ammonia is liberated by distillation of the two saturated magneso-ammoniacal mother liquors. This inconvenience can be entirely avoided by adding other salts to the solution of magnesium salt, either before the treatment with this solution of the gas containing ammonia, or after treatment, but before the liberation of the ammonia by the distillation of the saturated sludge. Experience has proved that an addition of salts of an alkali or ammonia is the more effective method. Salts of which the acid is the same as that of the magnesium salt are employed with advantage.

An example of the application of the process is described later; a solution of magnesium chloride, with the addition of chloride of ammonia, being employed to wash the gas. To obtain a solution of ammonia, concentrated to the highest possible degree, it is preferable, in practice, to take a solution of chloride of magnesia of 150 to 250 grammes to the litre, in which from 50 to 150 grammes of chloride of ammonia are dissolved. This solution likewise serves for the treatment of gases containing ammonia and carbonic acid until nearly all the chlorine of the magnesium chloride has combined with the ammonia without the mass becoming solid. Working with very concentrated solutions, ammonium chloride may even be deposited in the form of crystals without interfering with manufacturing operations.

On heating the saturated solution, there is liberated at first almost exclusively carbonic acid, which may be collected separately; and by heating up to boiling-point, the ammonia and the remaining carbonic acid are distilled. Liberation of the ammonia may be accelerated by working in a boiler under pressure, in order to obtain a higher temperature; but this is not essential, as it has been found that the liberation of the ammonia by basic combinations of magnesia is hastened by the presence of an excess of ammonium chloride or other salts.

The sequence of the reactions is shown in the following formulæ:—

I.—*Absorption.*

$$[MgCl_2 . 2\ NH_4Cl] + 2\ NH_3 + CO_2 + H_2O = 4\ NH_4Cl + MgCO_3.$$

II.—*Liberation of Ammonia by Distillation.*

(*a*) $$2\ MgCO_3 + 8\ NH_4Cl + H_2O = [MgCO_3 . Mg(OH)_2] + 8\ NH_4Cl + CO_2$$

(*b*) $$[MgCO_3 . Mg(OH)_2] + 8\ NH_4Cl = 2\ [MgCl_2 . 2\ NH_4Cl] + 4\ NH_3 + CO_2 + 2\ H_2O.$$

Thus the basic precipitate of magnesium carbonate is transformed again into magnesium chloride, without it being necessary to add lime or other analogous basic agent to liberate the ammonia. The ammonium chloride added to the solution of magnesium salt remains in the cycle of the magnesium salt solution.

The new method here described for the extraction of ammonia has the great advantage over those at present in use of not requiring the addition of lime. It is not even necessary to continue the distillation process until all the insoluble magnesium compounds are again dissolved, and all the absorbed ammonia is liberated. The solution remains in cycle, and is again utilized to absorb the ammonia in the gas. The proportions of solutions already mentioned may be altered as desired. Sufficient ammonium chloride should, however, always be added to prevent coagulation of the mother liquors, either during the absorption or the liberation of ammonia.

# THE ANALYSIS OF GAS ACCOUNTS.

### Some Suggestions for Improving "Field."

IT will not be many months before "Field's Analysis" for 1906-7 will be making its appearance, telling of the progress individually made by the principal Gas Companies and Corporations during the past twelve months; and, with this in view, it might not be inopportune to suggest a few points which would add to its already admitted excellence.

IN the first place, under the headings of "Capital Authorized" and "Capital Raised," it is noticed that the amount of 3½, 4, and 5 per cent. stock of the Gaslight and Coke Company and the 3½ and 4 per cent. stock of the Commercial Company are added together, and given as one total in each instance. It is consequently necessary to obtain the information elsewhere in the case of these two Companies, though the various stocks of the Suburban Gas Companies are separately stated. The addition of these few figures would simplify matters to statisticians and others interested in the purely financial details of the various Companies.

Secondly, would it not be possible to separate the figures for water gas made from those relating to coal gas? The proportion of water gas made by the different Companies varies from *nil* in the case of the South Metropolitan Company to 50 per cent. in that of the Tottenham Company; consequently, the inclusion of both sets of figures under one total renders a proportion of the returns, though very interesting, quite useless for comparative purposes. For instance, under the heading of "Coal" is included "Oil" and "Spirit;" and the amount spent under this heading is worked out to the cost "per 1000 feet sold." The next column states the amount received from the sale of residuals; and these are also worked out on the "per 1000 feet sold" basis. The succeeding column gives the cost of coal including oil and spirit, less the amount received from residuals; and this is shown under the heading of "Net Coal." Now, if all the Companies produced the same proportion of water gas, these figures would make a true comparison; but as this is far from being the case, it is essential for the figures relating to the different gases to be separated.

In the manufacture of carburetted water gas, the cost of the material—coke and oil—from which it is made, worked out on the "1000 cubic feet" basis, does not differ very largely from the cost of coal per 1000 cubic feet in making coal gas. But the saving in the cost of labour in the case of the former does not counterbalance the substantial amount received from the sale of residuals in the case of the latter. Consequently, though the total cost of making either gas does not ever differ very much—this being chiefly due to the small amount needed in the case of water-gas plant for interest on capital—yet the figures as to the net cost of coal vary considerably according to the proportion of water gas made. For instance, in the case of the Tottenham Company, who make a large proportion of water gas, the cost is 10·18d. per 1000 cubic feet, while with the South Metropolitan Company it is only 3·29d. This is, of course, quite an extreme instance; but it will serve to show that this figure must vary according to the proportion of water gas made. The figures under the headings of "Coke Made per Ton of Coal Carbonized" and "Coke Used for Fuel" must be merely estimates; and for this reason they are really of little value, and might well be omitted. An extra column, under the heading of "Pounds of Sulphate Made per Ton of Coal," would be appreciated for comparative purposes by most engineers and managers.

The Board of Trade Returns give separately the quantities of coal gas and water gas made by each undertaking, and also the maximum proportion of water gas supplied. These are interesting figures, and they would be a distinctly useful addition to "Field's Analysis." It is noticed that the cost of wear and tear varies very considerably. This is no doubt partly due to the policy—and a wise one—of many Companies apportioning large amounts of capital expenditure to the revenue account under the heading of "Wear and Tear"—thus swelling the figure out of all proportion for comparative purposes. Could not this capital expenditure be stated under the separate heading of "Extra Wear and Tear"? Two additional columns, giving the make of gas per ton of coal and per mouthpiece (stating the size), would be also of considerable interest.

There is not the slightest doubt as to healthy rivalry, whether with neighbouring *confrères* or with electrical competitors, being the best incentive to progress. Comparative figures are the food of this rivalry, and without them it would be non-existent. They show loss and waste, excite envy, and promote progress, level-down expenditure, and are quite as necessary to the proper conduct of a business as is systematized bookkeeping. Therefore the more complete the returns, the more complete will be the tendency towards progress. The compiler of "Field's Analysis," by the expenditure of an enormous amount of labour, gives most interesting and instructive returns; and therefore it seems ungrateful to suggest any lengthening of the already mammoth task

of compiling so useful a work. But it would indeed be a perfect analysis that could not advantageously bear to have any additions or alterations.

## MOTOR-WAGGONS AND GAS-GENERATORS AT THE AGRICULTURAL HALL.

It must be confessed that what was to be seen at "Cordingley's Twelfth Annual Automobile Exhibition" on the first day of its opening, last Saturday, was rather disappointing; but perhaps on the closing day (next Saturday) the exhibits will be more numerous and more interesting. Last year we commented rather fully upon the steam-motor waggons that were then exhibited and were likely to prove of interest and of benefit to gas engineers. This year it is not proposed to enumerate all such exhibits, but only to draw attention to the points of particular novelty which may not have been on show twelve months ago.

The St. Pancras Iron-Works Company, in the Great Hall, show their standard five-ton steam-waggon, fitted with patent radial return-tube boiler and rocking fore-carriage. The boiler is an attempt to combine all the advantages of both the water-tube and horizontal locomotive types, without their drawbacks. With steam-propelled vehicles, the boiler is undoubtedly the most vital part of the waggon; and the greatest possible care should, therefore, be taken in its design and manufacture. The return-tubes of the St. Pancras boiler effect complete exhaustion of the fuel gases before they pass out at the chimney. There is large heating surface, 92 square feet, which leads to economy of fuel; there are no stays, or consequent troubles from expansion; and there is every facility for cleaning. It is said that the boiler will make steam automatically on a gradient of one in six with a full load. One of the new improvements in this waggon is the introduction of an intercepting valve, by which both the engine cylinders (it is a compound engine) can receive steam direct from the boiler—thus making the engine for the time being double high pressure. The usual pressure is about 200 lbs. For gas-works' purposes, the waggon can be fitted with a tipping body, if the rapid unloading of coal is required.

The heavy vehicles are, generally speaking, shown together in the Small Hall. Here, on the left, is a new type of a six-ton steam-waggon made by the Yorkshire Patent Steam-Waggon Company, of Leeds. The horizontal engines have now been replaced by vertical ones, by which substitution greater accessibility and simplicity of parts have been obtained. The framework has been made stronger, and a larger tank adopted, so that now an average run of 20 miles can be made. At another stand, Messrs. Alley and MacLellan, of Glasgow, show their "Sentinel" six-ton waggon, one feature of which is that it does not carry any gear-box—there being a direct drive to the back axle. A five-ton waggon, which has been ordered by a steam coal company, is exhibited by Mann's Patent Steam Cart and Waggon Company, of Leeds. It is of very heavy build, and on the platform is fitted a set of separate steel boxes or compartments upon runners. These bunkers can be run to the side of the waggon and there self-tipped—thus supplying given quantities of coal as and where desired. The other exhibits are mostly of the traction-engine type, as made, for instance, by Fodens Limited, Tasker and Sons, Burrell and Sons, and Wallis and Steevens.

Certainly the most interesting exhibit of all was not to be found in the Hall itself, but just outside in the street. It consisted of the "Renard Road Train," made up of a 75 H.P. Filtz motor, with two passenger carriages and one covered luggage van. Each vehicle is on three pairs of wheels; the middle ones being the drivers. All the vehicles are connected together by means of a jointed rotating shaft running underneath the train. This directly transmits the driving power from the motor in front to each component part of the whole train. In fact, each vehicle becomes a self-propelled one, though connected to, and able to assist, the others. The driver has perfect control of the steering arrangements; and the narrowest and most difficult curves can be successfully negotiated. For country districts, or for military purposes, the train should prove of the greatest utility.

The gas engineer, in strolling round the Large Hall, could not fail to be struck by, and probably somewhat sceptically amused at, a trio of stalls bearing the following names: The Economic Safety Gas Company, Limited; the National Air-Gas Company, Limited; and the Non-Explosive Gas Syndicate, Limited. The last-named, indeed, announces in large letters that it is the purveyor of the "World's Safest Light," which seems rather hard on the first "Economic Safety" Company. But the most convincing proof of the extreme "safety" of these gas-lights is to be found in the eloquent fact that the Exhibition or Hall authorities would not allow any of them to have their generating apparatus at work in the building. The plant manufacturing the "World's Safest Light" was ignominiously relegated to some secluded spot outside. Of course, all these Companies or Syndicates are exploiting a mixture of air and gas from petrol; the apparatus consisting of a hot-air engine, blower, carburettor, regulator, and petrol container. The National Air-Gas system (on Glasscoe's patent) inaugurates, so a pamphlet informs us, a "revolution in lighting and heating." It is only 94 per cent. cheaper than electric incandescent lighting, and 75 per cent. cheaper than incandescent coal-gas lighting. Its light is "pure and sunny;" and it is more "salubrious" than coal or any other—health resort, we had almost written, instead of "gas." In short, it is "the most brilliant, healthy, safe, steady, and economical light hitherto produced;" and "it will pay any consumer to discard their [*sic*] present system, whether it be electricity, acetylene, coal gas, or oil-lamps, and instal this system." With such extravagant and preposterous statements does the National Air-Gas Company, Limited, seek to diffuse its "incomparably diffusive" light. It must be added that the Non-Explosive Gas Syndicate, Limited, who produce gas by Cox's patent machines, are very much more moderate and reasonable in their statements and the claims they put forth. In fact, in their pamphlet there is little to which one could reasonably take exception.

Leaving "air gas" to work out its wonderful revolution, one may turn for a moment to the suction gas and engine exhibits. Messrs. Crossley Brothers and the National Gas-Engine Company had their usual exhibition plants at work generating the electric light for their stands. Kynochs Limited (the Forward Engineering Company) also had a particularly effective stall. A 39 B.H.P. gas-engine was running on suction gas, and driving a 64-ampere dynamo. Features about the engine were a self-starting pump using petrol, and an arrangement for varying the magneto ignition time of firing, so as to suit the quality of the gas or the amount of the load. A very practical object-lesson as to the uncertainty of suction gas was afforded, however; for, as our reporter passed out of the exhibition, this particular stand was in darkness, and two canvas-clad mechanics were seen busily engaged putting something or other to rights, watched by an interested crowd.

A glance at the hundred or so Aero exhibits and models of flying machines, of all sorts and shapes and sizes, brought home to one's mind the amount of thought and labour that many persons must now be putting into the problems of aerial flight; and the exhibited photographs of balloons and adjacent gasholders served to remind one of the connection of aeronautics and coal-gas manufacture.

## GAS POWER IN FACTORIES.

At the Meeting of the London Association of Foremen Engineers and Draughtsmen on Saturday evening, Mr. W. A. Tookey read a paper on the above subject. In the course of it he said he could not be considered as bigoted with regard to any form of power, because he was putting down at the present time a steam-engine, electric motors, and gas-engines. It was absurd for a consulting engineer to assert that gas-engines were the best under all conditions; the circumstances of each factory had to be taken into account before the power to be used was decided upon. Gas-engines had many advantages, and would be used more extensively as time went on. In the majority of cases, they were better and more economical than steam-engines; but they must be installed with discretion. Mr. Tookey gave an instance in which electricity was used as a stand-by when the gas-engines were being overhauled. The electric light people insisted upon a charge which would cover interest on their capital expenditure to provide for the power that might be used on emergencies, and the factory-owners resolved to give electricity a trial for one month. After three weeks, they had had enough of it. There was a tremendous drop in the voltage on the foggy mornings which had recently been experienced; and the girls at the sewing-machines were not able to see with the pin-heads of light from the electric lamps. Gas-engines were sometimes looked upon as tricky things; but if they were properly used, and were placed in charge of efficient men, they were satisfactory in every way, and thoroughly reliable. Referring to the employment of electricity for power in factories, Mr. Tookey stated that it was convenient and very clean, and had certain advantages—being especially helpful when there was a difficult transmission to arrange; but in the majority of cases the current cost too much with a normal load fairly steady, and not intermittent. He expressed the opinion that until there was bulk storage for electricity somewhat similar to gas, it could not compete with the latter for power as regards cost. The paper was illustrated by lantern slides; and at its conclusion a hearty vote of thanks was accorded to the author.

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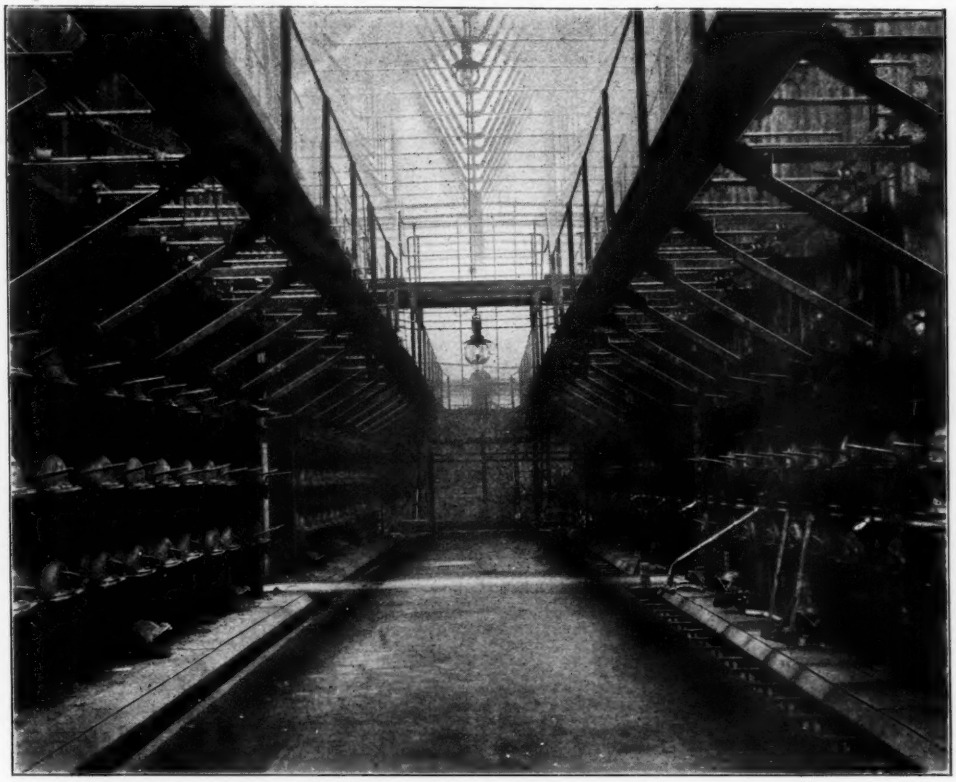
Mr. William Augustus Mitchell, of Danes Hill, Bengeo, Hertfordshire, who was one of the Directors of the Chigwell, Loughton, and Woodford Gas Company, left estate valued at £12,827.

The great strength sometimes exhibited by brick masonry well laid in good cement mortar is shown by a brick cistern, 7 feet in diameter and 10 feet deep, which was undermined by a flood at Terre Haute (Ind.), and floated away for some distance, without the breakage of any part of the masonry, or water gaining access to the interior.

The Bombay correspondent of the "Empress" writes: I suppose in all cities the corporation have to be economical; but when it comes to giving us no lights along the roads—because a moon is going to rise—it is not right or safe. One night our Municipality was "caught out," because as soon as the moon rose, its light was veiled by an eclipse, which left our Bombay roads in a dangerously dark state. A little study of the lunar system will have to be added to the many qualifications necessary for one aspiring to be a member of our Corporation!

# INCLINED RETORT EQUIPMENT AT STOCKPORT.

First Article.



View Down the Retort-House on the Drawing-Floor—Showing the Hot-Coke Conveyor, &c.

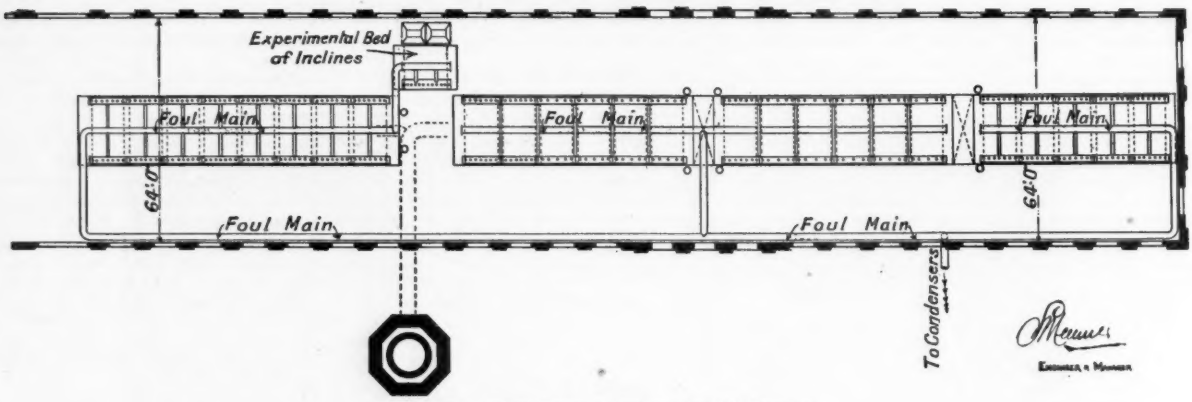
There is no better exemplification to be obtained of the progress that carbonizing operations have made than to compare the output of a retort-house when equipped with old-fashioned direct-fired settings, and of the same house when carbonizing plant of modern approved type has supplanted the old. But every house that is changed from the old order of things to the new has its individual internal and external characteristics, which require particular treatment. It depends entirely upon how such characteristics are treated whether or not the maximum effect is obtained from the limitations imposed by the house. That, of course, depends upon the engineer on whom falls the responsibility of making the conversion. And relatively to his success in producing, on economical lines, high results, the engineer deserves credit. This, however, we fear, is often lost sight of by those in the position to accord it. A man who makes two blades of grass grow where only one grew before is, it has been said, a benefactor to mankind. This is one of those old aphorisms that, in its literal sense, has its limitations in truth. But no such limitations can apply to the maxim in its application to the gas engineer when he succeeds in producing (say) two to three times more gas than formerly on a given area.

That is an object Mr. S. Meunier, the Stockport Gas Engineer, has been engaged upon for some time past; and we firmly believe that his carbonizing returns will anon show that he has succeeded. For he has been taking out some old direct-fired settings capable of making about 750,000 cubic feet of gas a day, re-plotting the ground space thus made available, and upon it has put up some inclined retort-benches, with a productive capacity equal to 2½ million cubic feet. Beyond the greater productiveness, there is the capital saved on the retort-house itself; for the same building that sheltered the old and (compared with present-day notions) uneconomical direct-fired settings, has, by the exercise of ingenuity, been made to do duty for the carbonizing plant of the much greater capability. Moreover, the improved settings will most certainly result in higher yields per ton of coal carbonized. In raising the productiveness of the site, and in effecting saving in the direction indicated, Mr. Meunier will ere long have proved himself a benefactor not only to the Corporation and the Gas Department, but to the consumers throughout the area of supply. And judging by the position of his capital account and the price of gas, he has already been that. Since he has been at Stockport he has more than doubled the output of the works; but his capital expenditure is a modest one per million cubic feet compared with what it was when he entered upon his appointment. The ordinary price of the gas is 2s. 4d. in the borough, and 2s. 8d. outside, with charges for power running down to 1s. 3d. and 1s. 4d. under certain considerable contracts.

We have said "by the exercise of ingenuity" the new plans has been got into the old house and in a manner that, there it already confidence in saying, will make working conditions there very pleasant. As the benches are examined, it is seen that they have an individuality in certain features; and in many ways there is projected upon one's notice the amount of scheming there has had to be to make the settings fit comfortably into a house that was built for the accommodation of plant of an altogether different type. There has, in fact, really been no alteration to the structure of the house—no raising of walls and roof; but, in view of the greater weight to be carried, owing to the complete character of the coal and other plant, the lower parts of the walls have been strengthened and re-faced. The other work on the structure has only been of a minor character—such as has been found necessary for the accommodation of the plant. The house is 64 feet wide; 30 feet from the floor-line to the eaves, with 22 feet rise of roof; and the portion occupied by the inclined installation is 145 feet long. Before determining what should be done with the space at disposal, several problems presented themselves to Mr. Meunier. There were twelve beds of direct-fired retorts right down the centre of the house—nine settings of fives, and three of sevens, 26 in. by 15 in. Directly in the centre, too, was a tremendous flue, 7 ft. 6 in. by 4 ft. 6 in., which it was thought well to utilize. All things considered, Mr. Meunier found that he could not put in horizontal retorts to work by machinery without adhering to open firing. This is why he turned his attention to inclined retorts. It is a case of choice being largely dominated by condition; but it must not be taken to imply any favouritism for the inclined system. It was simply manifest that inclined retorts would best fit the circumstances by an amount of adaptation in the design; and this shows the advantage that the gas industry has in possessing alternative methods of construction for retort-house plant. An experimental setting of inclines was erected, from which satisfactory experience was obtained that has enabled Mr. Meunier to design the new benches in a manner that will realize the utmost from the conditions that impose the limits, and also in a manner that will yield the best results.

## The New Inclined Benches.

Those, then, were the conditions—a given area, a house that was not to be altered, with a large main flue down the centre that was in such excellent condition that it could not be sacrificed; and for the house inclined benches were determined upon. The twelve beds of direct-fired settings were cleared away; the necessary excavations were made to 13 feet for the new benches, and to 10 ft. 6 in. for the clinkering-floor; some of the openings in the main flue were filled in (the remainder being utilized for the new furnaces). The concrete bed under the new benches is 1 ft. 6 in.

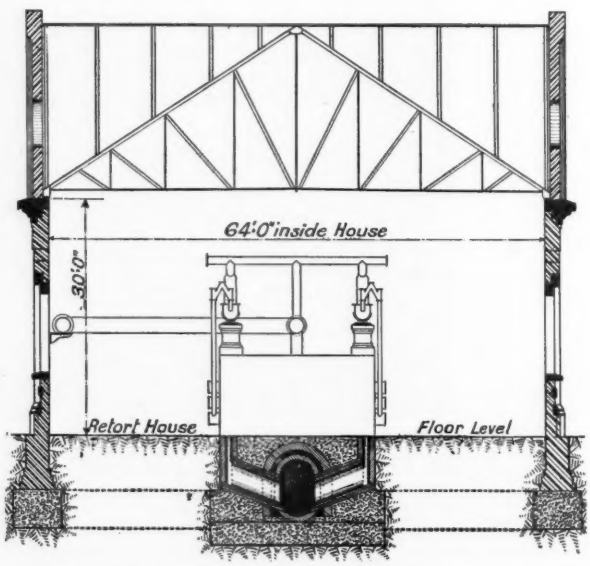



**Plan of the Retort-House—Showing the Old Benches.**

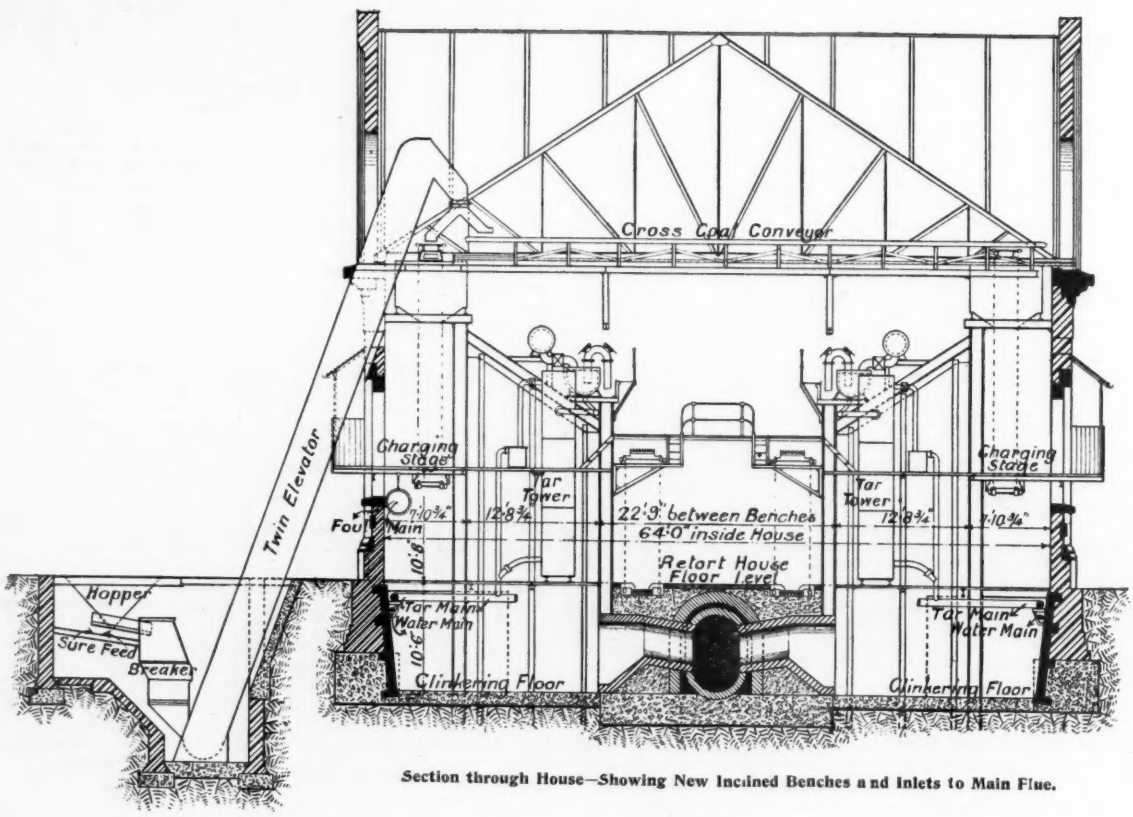
thick placed on a stratum of gravel or ballast. The new inclined retort-settings are arranged in four benches—two on either side of the house, with an 8 feet wide gangway through the centre from one side of the house to the other, and an iron bridge carried above, giving access to all parts of the plant, without interfering with the operations on the discharging-floor. There are four settings in each bench (sixteen in all), and twelve retorts, 22 inch by 15 inch by 15 feet long, in each arch; so that there are altogether 192 inclined retorts in the installation. The adoption of the 15 feet length of retort is due entirely to the exigency of space, in order to get the double benches in the 64 feet wide house. The span of the arches is 14 ft. 6 in., with 18-inch fire-brick division walls between, and 3 feet end piers, built of 2 ft. 3 in. red brick and 9-inch fire-brick. The arches are also partitioned centrally, from the furnace right to the top, by a 9-inch wall, so that the arches might be described as each containing two beds of sixes set in vertical tiers. The furnaces and the settings are of Mr. Meunier's own design.

### Circumstances Restrict Depth of Regenerators.

There are several peculiar features about these settings, produced by the circumscribed conditions. One is that there is a cellar on one side only of the benches; and that is on the charging side, which faces the outer wall of the house. This cellar is 10 ft. 6 in. deep from the ground-floor to the clinkering-floor. The single cellar is due to the old large main flue (to which reference has been made) running centrally beneath the drawing-floor. Seeing that the drawing-floor between the benches (which, by the way, is at ground level, and is paved with vitrified brindle bricks) is 22 ft. 9 in. wide, and the benches are 12 ft. 8¾ in.




**Section through House—Showing Old Bench and Inlets to Main Flue.**




**Section through House—Showing New Inclined Benches and Inlets to Main Flue.**

wide, it follows that there is only 15 ft. 9½ in. of the 64 feet. wide house to divide between the two charging-floors. Therefore, the space between the benches and the outer walls on each side of the house is only 7 ft. 10¾ in. wide. This brings us to the novelty introduced to obtain a larger clinkering-floor. Although the bench is only 12 ft. 8¾ in. wide, the depth of the regenerator from front to back is 4 feet less; and it strikes the notice immediately on going into the cellar, to see each furnace recessed by 4 feet. But the result of this form of construction is that the men get the ample space of about 12 feet distance between the furnace doors and the outer wall of the house for their furnace and clinkering operations. The arch, it is obvious, has been strongly built to carry the weight of the superstructure; and Mr. Meunier is fully justified in adopting this form of construction by the experience gained with the experimental setting.

### Conserving Heat and Preventing Radiation.

It will be observed by the drawing that the whole length of the house is not occupied by the inclined retort benches. At one end, there still stands a bench of regenerative horizontal settings. But in comparison with the inclined equipped part of the house, there is much more openness here; so that this will aid in the ventilation. The question of ventilation and endurable working conditions, with double benches of inclined retorts in a 64 feet wide house, were matters that demanded very serious consideration on the part of the Engineer. Taking a lesson from carburetted water-gas plant, he determined to conserve the heat of the settings and prevent radiation—at the same time protecting the men from the heat—by a plentiful application of slag wool, and by the provision of an air-jacket, in manner to be described, on the discharging side of the benches. In the first place, it was noticed that the mouthpiece lids are provided with a back plate; and slag wool is tightly packed between. The settings have front and back walls 13½ inches thick; and incorporated in them is a 3-inch thick lining of slag wool rammed in tight. On the charging side, the slag wool packing has been carried a little below the charging-floor; and the tops of the arches have also been packed. In addition, on the discharging-side of the bench, a 4½-inch fire-brick wall is provided in front of the bench; being carried to about a foot above the top mouthpieces. This serves the double purpose of a support for the mouthpieces, and also acts as an insulator. This additional wall is built (with the mouthpieces and ascension-pipes neatly bedded in it) a little away from the main wall of the setting, so as to leave space, through which, by means of openings, there is a continuous current of air passing. This provision for preventing radiation and conserving heat is most effectual; and a really interesting part of the structural work. It will certainly materially conduce to making the working conditions in this fully occupied house tolerable for the men. On the occasion of a recent visit, some beds of retorts were under slow fire; and while the retorts were attaining a temperature at which it would have been foolish to allow the hand to remain in contact with them, the outer surfaces of the walls of the settings were barely warm. There is no doubt that Mr. Meunier has hit upon a device here that, under his conditions in this house, will serve well the purposes in view. The whole design, it should be mentioned, is the result of experience derived from the experimental setting erected and worked some time previous to the planning of the larger installation.

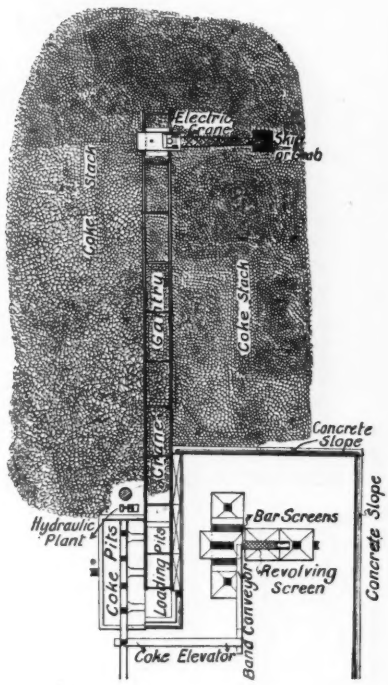
### The Bench Fittings.

Allusion has already been made to the packing of the mouthpiece lids, and following the bench mountings upwards, the extraordinary character of the ascension-pipes next invites attention. The straight upper parts of the ascensions are 7 inches in diameter; but the bends connecting them to the mouthpieces taper from 7 to 10½ inches in internal diameter—thus presenting quite a bell-shaped appearance at the lower part. The idea is to assist to an extent in preventing stopped pipes, and facilitate auguring operations. The arch-pipes are all 9 inches in diameter; and they are fitted with caps, the ease of opening and closing which greatly lightens cleaning operations. The caps are simply steel plates, swinging on a bolt at one end, and catching under steel hook bolts at the other—being, as a matter of fact, very similar to the old treacle valve. They form a good gas-tight joint, metal to metal; and they are particularly easy for the attendants to manipulate.

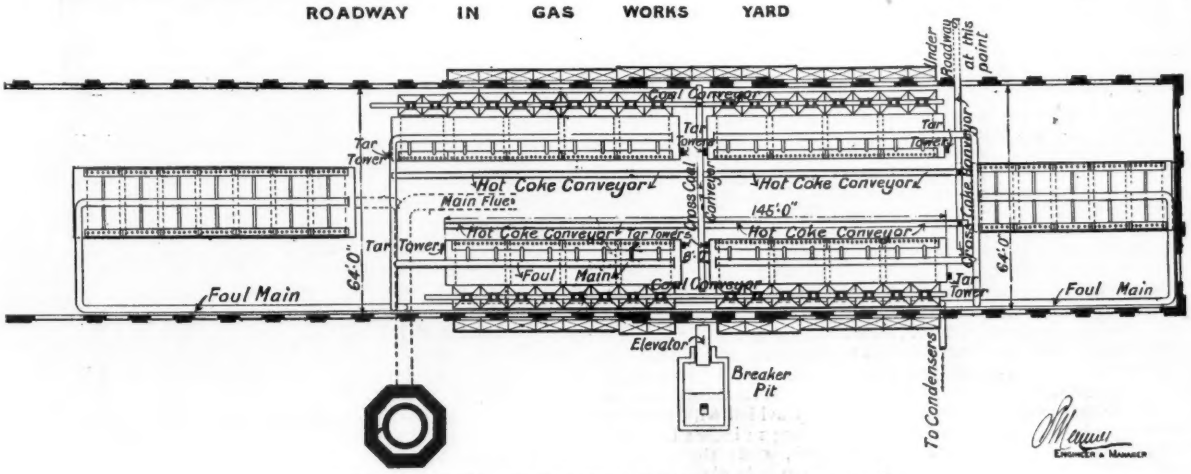
The hydraulic main and the method of taking off the tar are also the result of trials extending over the past two years. The main is 3 feet wide and 2 feet deep (inside dimensions), and of an irregular ⏢ section. The bottom is sloped some 1½ inches towards each tar take-off; so as to cause quick removal. Each setting has its own separate length of main; and each length is provided with two tar outlets. The tar-main is 6 inches in diameter; and each length receives the tar from two sections of hydraulic main. Two tar-towers, 3 ft. by 1 ft. 4 in. internal measurement, have been provided for each bench. The foul main is 24 inches in diameter. Four Parkinson and Cowan governors—one to each retort-bench—are provided for controlling the conditions within the retorts.

### Balcony, Platforms, &c.

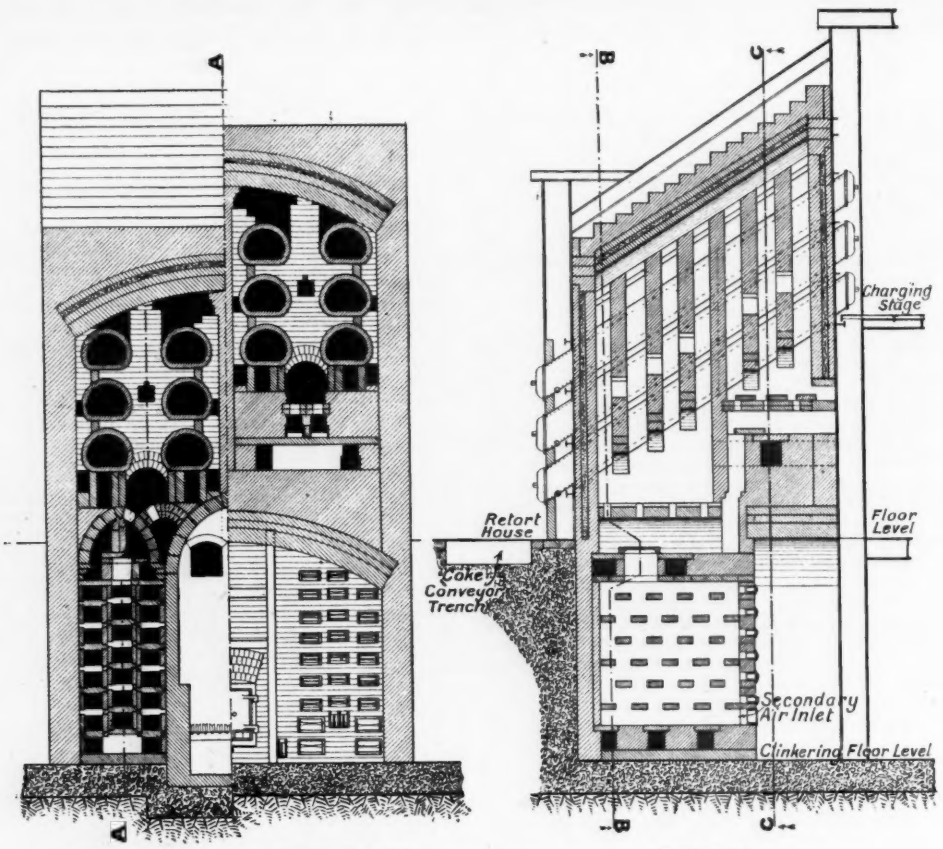
It has been shown that great care has been exercised to protect the operatives from the heat of the settings; and the Engineer has introduced another novelty in his consideration for the men. Carried along the outsides of the retort-house at the level of the charging-stages, are balconies, which serve the twofold purpose of giving the men plenty of opportunity for fresh air without descending from the charging-stage, and also of affording passage as charging operations are proceeding without interfering with the work. These balconies project about 3 ft. 2 in. from the main building wall, and are about 6 ft. 6 in. high. They are built of steel joists, standards, and rafters, with cast-iron floor-plates of open diamond pattern, and roofed in and covered partially at the




ROADWAY IN GAS WORKS YARD




Plan of the Retort-House—Showing the New Benches of Inclines.




Half-Section, BB. Half-Section, CC. Section, AA.

**The New Retort-Setting at Stockport.**

sides by galvanized iron sheeting. The charging-floors are also constructed of joists, covered with cast-iron plates, but of raised diamond pattern.

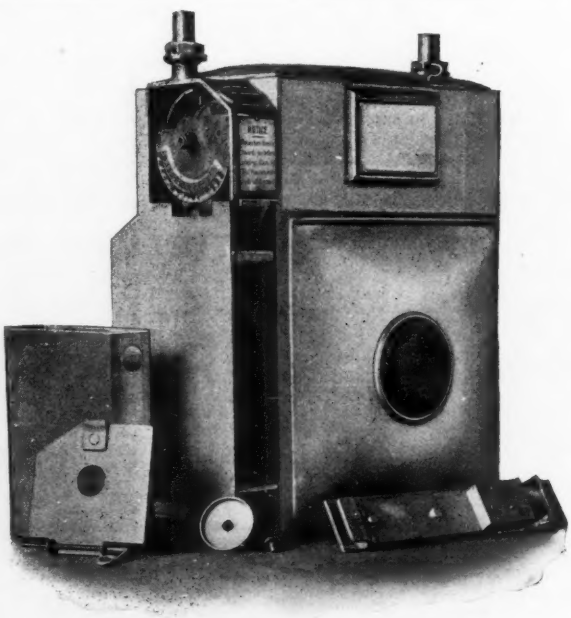
Mr. Meunier is minded, too, that there shall be every convenience for inspecting and keeping in good order the various parts of the plant. Reference has been made to the bridge running from one side of the house to the other. To the full length of the benches, are separate platforms for attending to the arch-pipes, coal-hoppers, and the overhead return of the coke-conveyor. Staircases and ladders lead to these conveniences, which, it must be admitted, make any inspection of the plant a very easy matter indeed.

Messrs. Gibbons Bros., Limited, were the contractors for the excavations, concrete seatings, retort benches and settings, bench ironwork, coal-hoppers, measuring-chambers, and shoots. The coal and coke plants were supplied by Messrs. R. Dempster and Sons, Limited; and these plants, together with the continuous coal-hoppers in the retort-house, will furnish the subjects for a second article.

## PINCHBECK PREPAYMENT METER STRONG BOX

THE case for the provision of a strong money-box for prepayment meters has previously been stated with fullness in the "JOURNAL," and the ground need not be again thoroughly traversed. A strong money-box is a preventative of robbery; a protection to the poor consumer against having his house broken into, and the money stolen from the meter; a protection to the supplier of gas against damage to meters; an aid to the police; and a help to the maintaining, instead of the lowering (as, in places, do the fragile money-boxes attached to some meters), of the standard of morality in a district. Of all subjects for robbery, hard cash has the greatest attraction. Robbery of money is not so readily traceable as is the robbery of goods. Unless specially marked, there is little about one coin to distinguish it from another of the same denomination; and therefore the more difficult is it to bring home a theft. Hard cash, too, is also immediately convertible, value for value, into goods. On all grounds, therefore, the prepayment meter strong money-box, in which money is continuously being lodged, is a desirable thing, so as to remove temptation and to protect.

Mr. J. Pinchbeck, of Holloway, has devised such a box, which possesses the virtues of strength, simplicity, and accessibility. This is the second strong box that we have had to notice of late; but our duty does not fortunately call upon us to bring the boxes into comparison. All readers can do that for themselves. In the case of the Pinchbeck box, its addition with the prepayment mechanism, adds less than 2 inches to the width of an ordinary meter, which is a consideration where installation has to be made in a cramped situation. The prepayment mechanism, as well as the inner receptacle for the money, is provided with a strong iron casing, the over-all measurements being 12 inches from top to bottom, 5¾ inches from front to back, while the width is (as already said) within 2 inches. The iron side plate over the mechanism is readily detachable by any one possessing a key for the front enclosing door; and so the price-changer can be quickly reached, thus lightening labour, and facilitating the alteration of the meters on a variation in price. This side plate has a lug at



**Details of the Pinchbeck Strong Money-Box.**

the top, which catches into a slot in the top part of the casing, while at the bottom there are two projections (turned inside) each with an eyelet corresponding in position to tubular slides on the permanently fixed side plate of the money-box casing, and in which slides and eyelets an iron rod engages, thus firmly securing the plate. The rod cannot be reached without the removal of the front door of the money-box. Looking at the illustration, it will be observed that there are two stout iron bars across the front opening of the money-box, and these bars are the means by which the door to the box is secured. The door itself is composed of two iron plates riveted together—the inside plate being curved at the bottom, forming a kind of saddle, to allow it to be securely attached to the lower cross bar. The same inner plate affords the means for securely carrying the lock without giving any external indication of how it is fixed. The upper bar supplies the catch for the bolt of the lock; and, when locked, the whole is a substantial structure, which will offer good resistance to the would-be thief.

The interior money-box is commodious—being some 6½ inches deep, 5 inches back to front, and 1½ inches wide; and it is made of tin of a stoutness which will stand much hard wear.

We may again commend the adoption of strong boxes for new prepayment meters, and for application when existing meters are taken out for repair. We are satisfied that their utility is far-reaching. They cost little more than the ordinary style of box; but their effect in certain towns is, and must be, great. The character of population, of course, is a determining factor in the matter of adoption.

## COAL GAS FOR AIR-SHIPS.

The above heading may strike a reader as being somewhat fanciful or far-fetched. Perhaps it does seem so at first sight; but the question of the use of illuminating gas instead of pure hydrogen for directable or steerable balloons (if the expressions may be allowed) or air-ships, or whatever name may be adopted, is of sufficient importance for it to be discussed by the Società Aeronautica Italiana. However near or distant may be the time when gas-works become the charging stations for vessels or vehicles navigating the air, their suitability for such a function has already been noted by enthusiastic aeronauts. It would indeed be curious if gas-works ultimately became the source of supply for air-ships; for, as we know, there are many who attribute the discovery of coal gas to Minckelers, whose first investigations into the distillation of coal were made with a view of utilizing the gas for balloon purposes. So first and last, it is conceivable that coal gas and ballooning may be associated together.

As is well known, considerable progress has recently been made in air navigation; and notable success in steering, even against the wind, has been achieved, as shown by experiments with the "Zeppelin" and other air-ships. This success has been the cause of drawing increased attention to the character of the gas used for air-ships—whether they be the toys of intrepid sportsmen, the appliances of searching scientists or of military men, or the vehicles of future generations. Thus it is that Captain Guido Castagneris has been investigating the question of using illuminating gas or pure hydrogen in the present state of development of the art of aerial flight.

The question, he says, of the cheap and ample production and supply of gas for balloon purposes, has now become one of importance and immediate utility. The advantages of air-vessels of large cubical capacity over those of small size have been proved. Will the large quantities of gas at a suitable price that will be required be forthcoming? The use of pure hydrogen, as hitherto, has enabled vessels of small capacity to be adopted, and thus in military operations, the small amount of gas needed has enabled considerable distances to be covered from the source of supply. But the gas had to be of great purity, and was therefore costly and rare. It cost at least 1 franc per cubic metre. The sale price of coal gas varies from 12 c. to 30 c. per cubic metre, and, for ballooning purposes, is generally supplied at from 12 c. to 15 c. per cubic metre. This shows, therefore, a saving of 85 c. as compared with pure hydrogen. There is, however, to be taken into account, the greater expense in benzine for the larger motive power required by the more bulky vessel filled with coal gas. The author, therefore, makes a comparison between an air-vessel using hydrogen gas and one using illuminating gas. The volume is taken at 10,000 cubic metres for the former and 16,900 cubic metres for the latter; the ascending power of hydrogen gas to coal gas being as 1100 is to 650. The comparative cost works out as follows:—

| | Hydrogen Gas. | Illuminating Gas. | Saving with Illuminating Gas. |
|---|---|---|---|
| Expense of inflation | 10,000 frs. | 2,535 frs. | — |
| Ten inflations per year | 100,000 ,, | 25,350 ,, | 74,650 frs. |
| Recharging, 2 per cent. per day | 200 ,, | 51 ,, | — |
| ,, for 300 days | 60,000 ,, | 15,300 ,, | 44,700 ,, |
| | | Total | 119,350 frs. |
| *Less* extra cost in benzine for 10 hours per day for 300 days per year | | | 39,690 ,, |
| | | Net saving | 79,660 frs. |

Captain Castagneris proceeds, however, to suggest that with some special extra purifying of coal gas, its ascending power could be increased from 650 to 850 grammes. For this extra purification, which, he says, offers no technical, organic, or practical difficulty, 5 c. per cubic metre could be allowed; and the calculation as above then works out to a net saving of 99,700 frs. Further, it is to be remembered that now there are hardly any districts that have not gas-works within 80 to 100 kilometres (50 to 62 miles); so that there would be the great advantage of numerous sources of supply. Gas-works, in short, are to become the power stations of the future motor-cars of the air. Such an idea may at present appear to be nothing but a flight into the realms of Jules Verne-like imagination. But who can tell? At all events, the Italian Aeronautic Society are looking to gas-works to support their efforts towards practical and industrial aerial navigation.

## GAS-MAKING COAL IN KENT.

In a paper recently read before the Society of Arts, Professor W. Boyd Dawkins gave a summary of the results obtained in the investigation of the south-eastern coalfield. At present the seams proved are at Dover, thirteen seams, with an aggregate thickness of 22 ft. 6 in.; at Waldershare, four seams, 10 ft. 3 in. thick; and at Fredville, three seams, 7 feet thick. At Dover the coalfield is about 1000 feet below Ordnance datum. The borings, it may be remembered, are being carried out by the Kent Coal Concessions, Limited; and an interesting and important fact in connection with them, so far as our readers are concerned, is that some of the coal found is suitable for making gas. A sample from the 4 ft. 4 in. bore at Fredville was recently submitted to Mr. George R. Hislop, F.C.S., the Engineer and Manager of the Paisley Gas-Works, who reported upon it as follows:—

The coal is of the bituminous class, and possesses considerable lustre. In cross fracture it is angular and resinoid, and is of fairly uniform composition. The specific gravity is 1227 (water 1000), and the weight of one cubic foot 76·6 lbs.

*Proximate Analysis.*

| | Per Cent. | Lbs. per Ton. |
|---|---|---|
| Volatile matters | 28·31 | 634·144 |
| Fixed carbon | 60·67 | 1,359·008 |
| Sulphur | 0·76 | 17·024 |
| Ash | 10·26 | 229·824 |
| Water | .. | .. |
| | 100·00 | 2,240·000 |

*Ultimate Analysis.*

| | Dry Basis. Per Cent. |
|---|---|
| Carbon | 78·03 |
| Hydrogen | 5·44 |
| Oxygen | 4·67 |
| Nitrogen | 0·84 |
| Sulphur | 0·76 |
| Ash | 10·26 |
| Hygroscopic moisture | .. |
| | 100·00 |

The calorific or heat-producing power of the coal, as determined by Thomson's calorimeter, is: 1 lb. of the coal by perfect combustion evolves heat sufficient to convert 13·80 lbs. of water from 212° Fahr. into steam. Therefore 1 lb. will raise 13,330 lbs. of water 1° Fahr., equivalent to raising 74·06 lbs. of water from 32° to 212° Fahr., 87·69 lbs. from 60° to 212° Fahr., and 11·92 lbs. from 60° to 212° Fahr. and thence into steam.

*Remarks.*—Notwithstanding care having been taken to remove the foreign matters in the sample under test, I am of the opinion that the somewhat high percentage of ash given is due to a proportion of the foreign matters having been left, and that the coal when raised in bulk should not contain more than from 5 to 6 per cent. This reduction in ash would relatively increase the amount of heat-producing elements in the coal, and even after allowing natural moisture in the coal (which in the sample could not be determined), the results now given would be fully maintained. This coal when raised in bulk would, in my opinion, be well suited alike for gas, steam-raising, and household purposes.

Two samples of coal from the 5 ft. 2 in. seam in the Waldershare boring were submitted to Mr. Hislop, who reported upon them as follows:—

A.—*Sample Free from Foreign Matters.*

| | Per Cent. |
|---|---|
| Volatile matters | 40·23 |
| Fixed carbon | 52·66 |
| Ash | 1·90 |
| Water | 5·21 |
| | 100·00 |
| Evaporative power in lbs. of water from and at 212° | 14·73 |

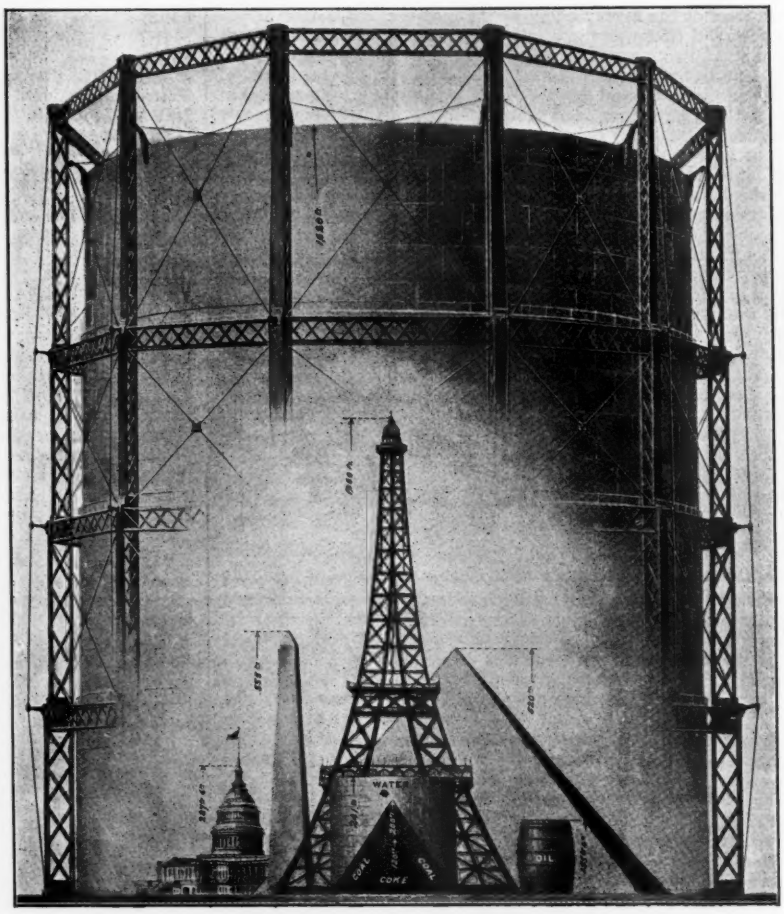
B.—*Mixed Sample, after Separating 71·4 % of Foreign Matters.*

| | Per Cent. |
|---|---|
| Volatile matters | 36·31 |
| Fixed carbon | 55·16 |
| Ash | 2·90 |
| Water | 5·63 |
| | 100·00 |
| Evaporative power in lbs. of water from and at 212° | 14·58 |

*Remarks.*—The above results prove Sample A to be an exceptionally valuable coal for gas manufacturing purposes, and it will yield approximately 13,000 cubic feet of 23·5-candle gas. Sample B is a valuable coal for such purposes, and will yield approximately 12,500 cubic feet of 22·5-candle gas.

## THE MAGNITUDE OF THE GAS INDUSTRY IN THE UNITED STATES.

In another part of the "JOURNAL" we give some statistics relating to the production of gas, coke, tar, and ammonia in the United States in the year 1905, extracted from a report prepared by Mr. Edward W. Parker, of the United States Geological Survey. The figures collected show the magnitude of the gas industry on the other side of the Atlantic; but it is more readily appreciated when represented graphically. We are able to do this by reproducing an illustration which appeared in the number of our contemporary "Light" for the past month. The total quantity of gas of all kinds produced in 1905 was 112,486,783,148 cubic feet, which would fill a gasholder 5829 feet in diameter and 4556 feet high. Assuming that a gas-engine consumes 92 cubic feet of gas per hour, being the mean between a minimum consumption of 70 and a maximum of 115 cubic feet per hour (Mathot's figures), this quantity of gas would run engines having an aggregate of 407,560 H.P. for ten hours a day for 300 days. According to the Twelfth Census of the United States, there were 14,884 gas-engines, which furnished 143,850 H.P.—a pitiful percentage of 1·3 of the total horse-power. Since this enumeration, the number of gas-engines in use has been materially increased; but the great bulk of gas is still used for illuminating and heating purposes. A comparison of the yearly production of gas is unwieldy, owing to the lack of objects with which to make it. The Eiffel Tower would look lost compared with a gasholder 4556 feet high; so our contemporary has taken a week's supply, which amounts to 2,163,207,368 cubic feet. This enormous bulk is shown in the illustration stored in a gasholder 1620 feet high and 1350 feet in diameter; the water being contained in a tank 241 feet high and 268 feet in diameter. The raw materials are also of a bulky nature. The coal carbonized would form a cone 268 feet across at the base and 200 feet high; and the coke a cone 120 feet high and 160 feet across. The oil used would fill a barrel 155 feet high and 122 feet in diameter. The results shown are truly astonishing.




Capitol, Washington. Washington Monument. Eiffel Tower. Great Pyramid.

**A Week's Supply of Gas in the United States. Fuel for 23 Million Horse-Power-Hours. The Gasholder contains 2,163,207,368 Cubic Feet.**

## SPENT GAS LIQUOR AND SEWAGE POLLUTION.

At a recent meeting of the Birmingham and Midland Section of the Society of Chemical Industry, a paper on "The Bacterial Purification of Sewage Containing a Large Proportion of Spent Gas Liquor"—the joint production of Dr. PERCY F. FRANKLAND, F.R.S., and Mr. H. SILVESTER, B.Sc., F.I.C.—was read and discussed. The following is an abstract of the paper, the full text of which, with tabulated results of the investigations described, is given in the current number of the Society's "Journal."

The authors began by pointing out that among the numerous refuse liquids arising in the course of manufacturing operations there is, perhaps, none which has a worse reputation, so far as purification by bacterial agencies is concerned, than the waste from the stills employed in the recovery of ammonia from gas liquor. Fortunately, there are comparatively few places where this particular form of waste bulks largely in the total volume of sewage to be treated. In the ordinary course of events, if the gas liquor is distilled for ammonia in the place where it is produced, the proportion which the waste bears to the total volume of sewage will be automatically restricted—a large quantity being possible only in a big town, where the volume of sewage will also be correspondingly great. In proof of this, the evidence given by Mr. Brotherton, the Managing-Director of Messrs. Brotherton and Co., before the Royal Commission on Sewage Disposal, in regard to Leeds and Wakefield, was cited. The authors said they were acquainted with only one place—Oldbury—where this particular waste liquor forms a really substantial part of the total flow of sewage. The cause of this is what may be described as the unnatural system of treating a large part of the gas liquor produced in Birmingham itself and in the district outside its drainage area. The population of Oldbury is only 25,000; and the dry-weather flow of sewage is 791,000 gallons, of which as much as 70,000 gallons, or in round numbers 9 per cent., may at times consist of the waste from the distillation of gas liquor. Consequently, any attempt to purify the sewage on bacterial lines would be attended with difficulties of a very exceptional character.

When the authors' attention was first directed to this matter, the sewage of Oldbury was being dealt with at works having the dimensions and employing the processes indicated below: The capacity of the eight lime-precipitation tanks was 483,000 gallons, and that of the tanks used as septic tanks was 302,000 gallons. The primary contact bacteria beds, which were 3 ft. 3 in. deep, covered 5615 square yards; the secondary beds (of like depth) extended over 3327 square yards; and the land (clay) for irrigation covered 3¼ acres. With these resources, they found that, though in general the effluent produced was highly unsatisfactory, when the spent gas liquor was either not present at all or only in small quantity, it contained nitrates, was non-putrescible, and in every respect was of fairly good quality. The fact that tolerably good results could thus be obtained, indicated that the ingredients of the waste liquor did not actually sterilize the bacteria beds. It therefore appeared to the authors probable that satisfactory purification might be realized, even in the presence of the larger proportions of the waste, by providing more extended opportunities of bacterial action.

The authors endeavoured to bring about these conditions by giving the existing double-contact beds only one filling of septicized sewage per 24 hours, instead of the three fillings hitherto employed. This mode of using the beds did not, however, yield a sufficiently favourable result to warrant recommendation, though it showed that even by this means a non-putrescible effluent, containing a large proportion of nitrates, could be obtained. They next proceeded to try the effect of giving triple contact, and experimented on these lines for more than two years. The following

figures (in parts per 100,000) show how successful the installation was in purifying sewage of exceptional composition:—

| — | Septicized Sewage. | | Final Effluent. | |
|---|---|---|---|---|
| | (1) | (2) | (1) | (2) |
| Albuminoid ammonia | 0·92 | 1·03 | 0·118 | 0·128 |
| Oxygen absorbed in four hours | 27·88 | 38·03 | 1·10 | 1·13 |
| Sulphocyanide (CNS) | 6·20 | 10·20 | nil. | 0·11 |
| Nitric nitrogen | nil. | nil. | 1·61 | 1·86 |

In all cases the final effluent passed the incubator test and supported gold-fish life. In the first series of experiments with this installation, the quantity of sewage applied varied from 343,339 gallons to 158,313 gallons per acre, while in the second series the variation was from 83,114 gallons to 34,301 gallons per acre; the final volume, after continuous use of the beds for many months, being 63,325 gallons per acre. The greatly reduced rate employed in the second series of experiments was necessitated by the loss of capacity of the primary bed when dealing with very strong sewage. This loss of capacity points to the desirability of having a considerable reserve of primary beds, so that the latter may be rested at frequent intervals. In other words, a larger area should be devoted to the primary beds than to either the secondary or the tertiary beds respectively.

The authors instituted a comparison between the efficiency of triple-contact and triple-trickling beds; and the following figures show that, although the amount of purification effected was very striking, it was distinctly different in character from that realized by the triple-contact beds. Thus while the nitrification was in most cases greater with the trickling beds, the removal of albuminoid ammonia and of oxidizable matter was almost invariably, and generally very considerably, less. The sulphocyanide, also, was hardly ever abolished, although it was greatly reduced. The defective purification was particularly noticeable when the septicized sewage was exceptionally strong, while the same sewage was successfully dealt with by the triple-contact beds, as shown by the following figures (parts per 100,000):—

| | Septicized Sewage. | Third Contact Effluent. | Third Trickling Bed Effluent. |
|---|---|---|---|
| Albuminoid ammonia | 1·5 | 0·08 | 0·712 |
| Oxygen consumed in four hours | 57·7 | 1·10 | 9·160 |
| Sulphocyanide (CNS) | 14·6 | nil. | 2·670 |
| Nitric nitrogen | nil. | 1·29 | 3·750 |

The volume of sewage applied to these beds varied from 425,000 to 189,707 gallons per acre per 24 hours; the smaller volume being put on when the sewage was exceptionally strong.

For a period of about seventeen months (from February, 1905, to July, 1906) the authors experimented with an installation of large triple-contact beds, particulars of which they furnish; and they then offer some general considerations. They say the experimental results they have detailed reveal in the most striking manner the extraordinary power possessed by bacteria beds of breaking down the great variety of chemical compounds. Analysis of the waste liquor showed that it contained sulphocyanides, phenols, thiosulphates, and tar bases in approximately the following proportions:—

| Matters in Solution. | Parts per 100,000. |
|---|---|
| Sulphocyanides (calculated as CNS) | 153·8* |
| Thiosulphates (calculated as S) | 46·8† |
| Phenols (calculated as $C_6H_5OH$) | 140·1 |
| Tar bases (calculated as nitrogen from the Kjeldahl result, after deducting free and saline ammonia, and the nitrogen in sulphocyanide) | 4·0 |
| Albuminoid ammonia | 14·2 |
| Oxygen consumed in four hours at 80° Fahr. | 500·0 |

* = 206·8 $Ca(CNS)_2$. † = 111·5 $Ca(S_2O_3)$.

But, as already pointed out, the waste amounts at the maximum to about 9 per cent. of the dry-weather flow of the Oldbury sewage. These chemical ingredients will, therefore, be present in the mixed sewage received at the outfall works in approximately the following proportions:—

| Matters in Solution. | Parts per 100,000. |
|---|---|
| Sulphocyanides | 14·0 |
| Thiosulphates | 4·2 |
| Phenols | 12·7 |
| Tar bases | 0·36 |
| Albuminoid ammonia | 1·3 |
| Oxygen consumed in four hours at 80° Fahr. | 45·4 |

These calculations are borne out by the actual analyses of the septicized sewage, which, when at its strongest, yielded the following figures:—

| Matters in Solution. | Parts per 100,000. |
|---|---|
| Sulphocyanide | 14·14 |
| Albuminoid ammonia | 1·75 |
| Oxygen consumed in four hours at 80° Fahr. | 54·20 |

These figures are of further interest, inasmuch as they show that the sulphocyanide is not destroyed in the septic tank, and that the oxygen absorbed is apparently not reduced there either. It appeared to the authors to be of interest to ascertain what effect the cheapest chemical oxidizing agent—bleaching powder—would have on the waste liquor; and they made three experiments with this object. The result was to prove clearly that the idea of oxidation by chemical means could not be entertained—even inadequate purification requiring the use of 0·3 lb. of powder of 35 per cent. strength per gallon of liquor.

### Conclusion.

In the summary to their paper, the authors said: The experiments we have made show that the presence of a large proportion of gas liquor waste in sewage occasions considerable, but not insuperable, difficulties in the purification of the latter by bacterial means; on the other hand, the oxidation of the waste by chemical means can only be effected at prohibitive cost, even with bleaching powder. By providing a larger area of beds, giving triple contact, and permitting only a diminished flow of sewage on to the beds, we have found that satisfactory purification can be effected of any proportions of gas liquor waste occurring in the Oldbury sewage—*i.e.*, as far as our experience goes, up to 9 per cent. of the total flow. The effluents obtained were non-putrefactive, supported fish life, and gave only reasonable figures for albuminoid ammonia and oxygen absorbed; while they were also almost invariably free from sulphocyanides, and contained an abundance of nitrates. The results obtained by triple trickling filters were less satisfactory as regards the figures for albuminoid ammonia and oxygen absorbed, and the sulphocyanides were less completely removed, though the proportion of nitrates was higher. If, however, the rate at which the liquid passes through the beds could be suitably retarded, there is every reason to believe that results of a similar character to those yielded by the contact beds could be obtained. The experiments we have made on gold fish indicate that the latter can live for at least 24 hours, without apparent discomfort, in solutions containing up to 250 parts of sulphocyanide (CNS) per 100,000. On the other hand, the experiments on *Bacillus coli communis* show that these micro-organisms are prejudicially affected even by 10 parts of sulphocyanide per 100,000.

The paper gave rise to a discussion, in replying upon which Mr. Silvester said it was certainly very undesirable that spent gas liquor should be sent into the sewers in rushes; and the manufacturers, on representations being made to them, had co-operated with the authorities by distributing the flow of the waste fairly evenly over the 24 hours.

## OBITUARY.

The death occurred on Monday last week of Mr. George Westlake, one of the Directors of Messrs. Willey and Co., Limited. Mr. Westlake had lived in Exeter practically all his life. He was apprenticed to the late Mr. John Vickary; and when the late Mr. H. F. Willey started business in 1868, Mr. Westlake was placed in charge of the meter department. He was retained in this position when the present Company was formed; and, under the policy of interesting in the concern those who held responsible positions in it, he was made one of the Directors. He was a thorough believer in good workmanship, and took a pride in the progress and welfare of the firm with which he was associated. Under his supervision, the meter department grew very greatly, especially of late years. Mr. Westlake was 71 years of age. He leaves a widow, three sons, and two daughters.

Many of our readers—especially those engaged in gas-works north of the Tweed—will learn with much regret of the death, on the 29th ult., at the age of 52, of Mr. Robert W. B. Creeke, the Managing-Director of Messrs. Henry Balfour and Co., Limited, of Leven, Fife. About six years ago, he had the misfortune to lose his sight; but he nevertheless was able to retain his position. His general health broke down in the autumn of 1905; and during the past winter he was in a frail condition, so that his death was not altogether unexpected. Deceased was a native of Leven, and on leaving school, nearly forty years ago, entered the engineering shop at the Durie Foundry. After passing through the different departments, he went to Edinburgh, and studied for two sessions at the University. On the completion of his course there, he went to South America, and in Valparaiso and elsewhere held positions of trust, and extended his knowledge of engineering. He returned to Leven in 1880, and at once took the position of Manager at the Durie Foundry. In 1884, he joined Mr. H. Balfour, a son of one of the founders, as a partner. In March, 1895, a Company was formed, with the title of Henry Balfour and Co., Limited, Mr. Creeke taking the position of Managing-Director. Until he lost his sight, he filled both positions with distinguished ability; and under his supervision the Company took a leading position in the manufacture of gas-works apparatus and other plant. Mr. Creeke was the patentee of the "annular" brush scrubber bearing his name, which was described in a paper contributed by him to the North British Association of Gas Managers at their meeting in Glasgow in 1901, and read for him by Mr. A. MacPherson, of Kirkcaldy. His achievements at the works after his severe affliction were truly marvellous; and he retained his position to the end. He is survived by a widow and two sons, one of whom is Mr. W. Russell Creeke, who is engaged in the works with which his father was for so long connected. These were closed last Tuesday, when the interment took place in Scoonie Cemetery, in the presence of a large attendance of operatives engaged in all departments, as well as of representative gentlemen.

# INFORMAL MEETING OF SCOTTISH GAS MANAGERS.

### Annual Meeting in Glasgow.

THIS meeting is now so well established in the hearts of Scottish Gas Managers, that it admittedly eclipses the summer meeting of the North British Association. It may be that the season of the year has something to do with the popularity of the gathering; it being the first opportunity which managers have of "getting off the chain" after the labours and anxieties of the winter. Another element which helps to induce managers to set their faces Glasgowards at this season of the year is their immediately prospective entry into negotiations for their coal supplies for the next twelve months. They not only have the benefit of conference with brother managers upon this all-important subject, but they get into personal touch with representatives of the coalowners, and are thus helped to feel their way into the market. In this respect the Informal Meeting is in reality a Commercial Section for coal, such as is being talked of in connection with the disposal of residuals. To these valuable offices which the Informal Meeting renders to gas managers there is to be added that of giving them an opportunity of discussing and settling their minds upon new forms of plant to be introduced into their works during the summer. Spring is thus the most suitable time of the year for managers to meet together for mutual help in their various business concerns.

The meeting, of which the proceedings are reported below, was in every respect a success. The address of the President—Mr. J. W. Napier, of Alloa—is a thoughtful production, covering many topics of interest to his brethren; while the discussion upon it was well sustained, and worthy of the traditions of the northern forum. [The address is referred to in our Editorial columns.] It will be gathered, however, from the remarks of the President, that an attempt is likely to be made to get the North British Association to review their decision upon the question of affiliating with the Institution of Gas Engineers. It may be taken for granted that the subject will not be raised unless there is a prospect of its being carried. Between this and July, therefore, we may look for something in the nature of *pourparlers* among the parties interested upon this subject, which is one of considerable interest to managers everywhere. The probability accordingly is that there will be a lively time at the next meeting of the North British Association. Another subject affecting that body which was freely handled was their method of administering their Research Fund. The criticism on this point was trenchant, but it cannot be said to have been undeserved; for the fund exists for the purpose of encouraging research, and has not been used with any fulness.

It was almost inevitable that something should be brought forward relating to the memory of the late Mr. James M'Gilchrist, of Dumbarton, who was the founder of the Informal Meeting, and who made his last public appearance at last year's gathering. The decision has been come to to provide a medal—presumably to be known as the M'Gilchrist Medal—to be given each year to the Chairman of the Informal Meeting, and retained by the recipient. It is open to doubt whether a better and more easily worked memorial would not have been, as was suggested by Mr. D. Robertson, of Dunoon, to have had one medal to be handed down from President to President. The Informal Meeting has no organization, and it will consequently be necessary to constitute a special one for the purpose. Besides, a memorial is something to keep in mind; and it is not customary to have, as will later on be the case in this instance, a number of gentlemen carrying about memorials to a former colleague. It is to be noted, too, that this decision apparently leaves open the question of what the North British Association are to do in the same matter. The prospect is that there will be memorials in connection with both bodies, which has the semblance of overdoing the business. It would probably have been better if the matter had been held over till after the Association had made up their minds upon a subject which is worthy of being well considered before a decision is arrived at.

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The Twenty-Fourth Annual Informal Meeting of Scottish Gas Managers was held on Wednesday last, in the Grand Hotel, Charing Cross, Glasgow. There was a large attendance—Mr. J. W. NAPIER, of Alloa, occupying the chair, in accordance with the vote at last year's meeting.

#### A MEMORIAL FOR THE LATE MR. J. M'GILCHRIST.

Mr. A. YUILL (Dundee) craved the indulgence of the Convener of the meeting to place before them a matter which he thought was worthy of their consideration. Those who were members of the North British Association would remember that at the meeting of that body in July last, the matter of a memorial to the late Mr. James M'Gilchrist, of Dumbarton, was before them, and was remitted to the Committee of the North British Association to devise some means for the perpetuation of Mr. M'Gilchrist's memory. The Committee were agreed as to the desirability of doing something, but difficulty had arisen as to the form which the memorial ought to take. Some of them thought of founding a scholarship, and approaching the Corporation of Dumbarton, to ascertain their views with regard to a tablet being erected in Dumbarton; others thought to do something for the Glasgow and West of Scotland Technical College; and others, again, that a medal might be given to the President or the Convener of the Informal Meeting. The Committee of the North British Association had thought it advisable to place the matter before the Informal Meeting, in order to ascertain their views upon it. The Committee thought that if a fund were raised, they would be able to purchase a medal which might be given to the Chairman of the Informal Meeting; and that this would perpetuate Mr. M'Gilchrist's memory better than any other form they could think of. He had much pleasure in moving that the Informal Meeting do take the matter into consideration, and appoint a Committee of their number to co-operate with the Convener to have this object carried out.

Mr. W. FAIRWEATHER (Kilmarnock) seconded. Those of them who knew their late friend, Mr. M'Gilchrist, were aware of the amount of work he did in connection with this meeting, and in connection with the meetings of the North British Association; and he thought it was very desirable that something should be done to perpetuate his memory. It was Mr. M'Gilchrist who inaugurated these meetings; and he was always anxious to see them carried through successfully.

Mr. J. NAPIER MYERS (Saltcoats) asked if the Committee were to consider the form the memorial was to take, or if it had been determined that it was to be a medal.

Mr. W. B. M'LUSKY (Perth), the Convener of the Informa Meeting, said that nothing had been determined on.

Mr. MYERS considered the proposal an eminently wise one. The spring meeting was the creation of Mr. M'Gilchrist; and he spared no effort to ensure its continued success and vitality. He thought that such a means as was proposed would help to perpetuate the meeting, and Mr. M'Gilchrist's memory connected with it.

Mr. D. VASS (Airdrie) wished, before they settled the matter, to express a view which he had in connection with the meeting. He considered it was purely a meeting of the North British Association, and that it should be conducted as such. It might be continued as an Informal Meeting of the North British Association; but he thought it was time that the North British Association were consolidating their energies. The Informal Meeting was simply a rival of the North British meeting, and the giving of the medal, as proposed, might be the creation of a permanent breach between the two—it might be the creation of a difficulty which there might be some difficulty in solving.

Mr. D. ROBERTSON (Dunoon) asked if the medal was to be the property of the North British Association.

Mr. M'LUSKY explained that if the meeting decided to have a medal, they would delegate powers to a Committee to raise subscriptions, and, having a fund accumulated, they would have to vest that fund in trustees, and the trustees would purchase the medal, and administer the fund.

Mr. ROBERTSON was quite at one as to the giving of a medal, but had difficulty as to its ownership. Was it to be one medal, to be handed on from President to President?

Mr. M'LUSKY explained that there was to be a medal every year, to be worn as a badge.

Mr. J. M'FARLANE (Maybole) put the question whether it was the interest of the fund which was to be used for the provision of a medal.

Mr. M'LUSKY said that was so, and that, so far as the sum of money was concerned, they need have no fear.

Mr. ROBERTSON suggested whether it would not be better to have a larger medal, and hand it from one President to another, with a chain attached to it—the President for the year to have the privilege of wearing the medal and chain. This would keep Mr. M'Gilchrist's memory fresher in their minds than any other way.

Mr. YUILL took it that, there being no counter-motion, the one he had put before the meeting had been accepted; but he thought that the remarks of Mr. Vass required some consideration. He wanted them to amalgamate with the North British Association.

He would be a very bold man who would approach the North British Association and ask them to affiliate, after the position the Association took up at St. Andrews, when they declared that they would not affiliate with anybody. It would be better that they should keep up their present position as an Informal Meeting. The North British Association could stand by themselves; and he thought that they, from the period they had existed, had proved that they could stand by themselves. With reference to the Committee to be appointed, he suggested the Chairman of the meeting (Mr. J. W. Napier); the Convener (Mr. W. B. M'Lusky); Mr. W. Fairweather; Mr. L. Hislop; and himself. This would make a workable Committee of five; and he was sure they would be able to carry the matter to a successful issue.

Mr. MYERS moved that the Committee named be appointed; and this was agreed to.

Mr. A. WADDELL (Dunfermline) asked if the Committee were to be a standing one, or whether they were to act only in so far as the getting in of subscriptions was concerned, and to see the first medal purchased.

Mr. YUILL replied that they would only act for the year, to bring the matter into practical shape; and it would then lie with the meeting next year to take any action they might think fit.

Mr. VASS pointed out, in reply to Mr. Yuill, that the origin of the Informal Meeting was the outcome of an endeavour to get rid of a rival—that was, the amalgamation of two Associations to form the North British Association. Many managers found that they were losing a very useful meeting in the spring, and therefore the Informal Meeting was started. He held, still, that the meeting should be part of the North British Association.

## THE PRESIDENT'S ADDRESS.

The PRESIDENT then delivered his Presidential Address, as follows:—

The course of time has once again brought us together; and standing still for the moment, we endeavour to poise our thoughts and take measure, in manner of retrospect, of the accomplishment of things, the prosperity that has made more permanent the great industry we represent, and the progress achieved in the practical development and application in the manufacture and use of gas—all of which we profoundly recognize to have been, in measured degree, satisfactory and hopeful. We live in a strictly commercial age, when competition is our hardest taskmaster, yet I venture to say that reliability and cheapness—the integral factors of success—have placed gas in the position of being able to maintain its popularity, as well as to increase the stability of its undertakings throughout the country. We shall have noted how the trend of invention, in its wide range, has made, and is likely to make, step by step significant changes in the practical production of gas. In the utilization of gas for lighting, perfection of attainment has reached a very high level. For heating purposes—and within the domestic circle, more especially—the efficiency of appliances may fairly enough be said to have advanced just a little as regards much needed economy and control of consumption. For the requirements of power, the use of coal gas has been made to call a halt, and the advent of suction gas has presaged two points especially worthy of note—namely, the great demand for cheap gas for industrial purposes, and the absolute necessity on our part of making concessions in price, on a differential basis, in order to meet competition for the valuable day-load factor. This latter phase of business will be referred to more fully later on. In thus speaking generally, and in full view of the past year's record, there is to be found much reflective lesson in gauging the collective real accomplishment, and how imperative is the duty of the individual to strive after further gain.

### THE DEATH ROLL.

In making a slight departure from the usual custom observed in the Chairman's address, I feel it my duty, as you will expect of me, to refer, but very briefly, to the demise of Mr. James M'Gilchrist and Mr. William M'Crae. Mr. M'Gilchrist, with an enthusiasm and loyalty peculiarly his own, initiated our annual informal meetings—an institution in the affairs of Scottish Gas Managers that has proved of considerable value and benefit. It is, therefore, with peculiar appropriateness that we should look upon our annual spring meeting, in both its business and social aspect, as a fitting memorial of one whose personality loomed large in our midst, and whose life was crowded with event. Mr. M'Crae, my immediate predecessor in the chair, lived a strenuous and hard-fought life in the varied circumstances in which time and tide placed him. To those who knew him intimately and for long, there was present a warm true heartiness of spirit and an everlasting desire to do faithfully the duties that lay before him. In his own words, which echo themselves back, in speaking at the close of the dinner at last year's meeting, and made in reference to his brother, Mr. John M'Crae, "he died far too soon."

I cannot allow myself to pass on without referring to one whose loss is most recent. It is given to few men to become real pioneers; and in speaking of Mr. William Young and his life work, we think of the strong individuality pressing forward into the unknown, making knowledge to grow, and fruition of labour the source and the wealth alike of new industries. To many of us he was known personally; and we have fragrant recollections of listening to him delivering most valuable contributions from time to time. The reaction of idea upon idea in his mind yielded interminable energy for experiment. Of William Young we think silently, and pause, and give expression to our thoughts in the words of the living poet—

> "The World grows Lilliput, the great men go.
> If greatness be
> It hath no outward sign."

Words emblematical of the position he occupied in relation to our industry, and true of the modesty of his personality.

### THE COAL QUESTION.

Probably the most outstanding feature in the past winter's work was the enormous difficulty experienced by many gas-works in obtaining supplies of coal. The scarcity of coal was only apparent, not real. The output of coal from the collieries, while in some cases normal, showed a very considerable increase when compared with the same period of the previous year. The amount of coal shipped for the four months November, December, January, and February pretty clearly indicates the increased output; and this does not take into account the increase for home requirements. During the four months mentioned, the coal exported from the United Kingdom in 1905-6 was 15,834,600 tons; and in 1906-7, 18,254,400 tons.

The remission of the coal-tax on Nov. 1 was the means of increased export of coal, and, with better prices at the time, may be taken as the reason for coal being diverted in another direction. In this matter, which is sufficiently serious to every one of us, it will be well if the usual conditions of contracts were revised where necessary, so as to ensure delivery of material when required, instead of our being made to suffer at an anxious time—knowing that coal was procurable, but was being sent past us.

Regarding the increased price we are likely to be called upon to pay for coal during the ensuing year, one might enter a slight protest against an inflated rate which the trade of the country cannot be said to warrant. The home demand has been a little above the normal, but nothing of the nature to influence prices to such an extent as they have reached. The large prices obtained for shipment have had a reflex action on home rates, regulating and increasing the prices that we are called upon to consider. Increase in miners' wages and short hours of working are additional factors to take into account.

The gas industry, in its demand for coal, cannot be said to present any difference now compared with the immediate past. It is singular, therefore, and upsetting to our endeavours to secure economies inside our works in order to reduce rates for gas, that gas-works should be subject to the unsettling influence of an abnormally increased price for raw material; and this taking place, not in a gradual way, but in sharp upward rises in value, and brought about by an increased demand for the export of this valuable asset of our country's wealth, due to the remission of a tax which was at once necessary and protective.

There are, however, visible signs that, with the lessened demand as the season advances, a slightly decreased rate will be asked, and that the advance necessary in the price of gas will not be so urgent, or so great, as at one time seemed probable.

### RETORT-HOUSE PRACTICE.

The outstanding features of marked change in the work of the retort-house are of sufficient importance to merit our attention and criticism. The constant endeavour has been to obtain the largest possible yield of gas per ton of coal; and carbonizing practice on already well-determined lines appears to have satisfied us as to the relative value, in this respect, of one coal with another. In other words, under the best possible conditions of temperature in the horizontal retort, the maximum gaseous volume that a certain coal can give, has been ascertained; but this cannot necessarily be held as a conclusive result, having regard to the principles of destructive distillation by means of heat. Carbonization of coal in retorts cannot be looked upon as if the operation was only a simple chemical one, the composition and volume of the resulting products being according to preconceived theory. A close observer of the physico-chemical laws of the action of heat on coal in closed vessels may venture to say that no one at the moment can definitely state the volume of gas it is possible to produce from a ton of coal from destructive distillation, which may be anything according to the method pursued as determining conditions the most favourable. This statement is made having regard to increased volume at the expense of illuminating power, but is conceived having in view that development in the demands of gas supply for the future will be in selling a gas of an illuminating value determined by the utmost economical practical conditions of working, of high-flame temperature, and of calorific value of higher standard than that of producer gas. It is well at times to postulate what are the leading lines of policy; and a low selling price of gas will be reached by carrying out our operations on scientific lines, producing an increased volume of gas, reducing labour costs, and obtaining a larger nitrogen value as ammonia from the coal.

It is with considerable confidence, therefore, that we look to the vertical retort being the means of putting our carbonizing practice on more scientific lines. In keeping with the theories propounded by the late Mr. Young regarding the action of radiant and contact heat on gases, the Young and Glover retort is the practical outcome, and is fundamentally different from the Continental types, which require the retort to be completely full of coal. The vertical retort is a serious attempt to fractionally distil coal at the most suitable temperatures in proper sequence, obtaining a double yield of ammonia, and, what is of very great

importance, labour costs equal to shale-works practice—about 3d. per ton. In this form of retort, the patentees purpose introducing steam in regulated quantities near to the bottom of the retort, where the temperature is favourable for the production of ammonia. The steam will be decomposed in passing through the body of coke, water gas being formed; the nascent hydrogen combining with a portion of the nitrogen remaining in the coke. This, in my opinion, is the hazardous part of the process. In the practice of distillation for the manufacture of paraffin oil, it has been observed that a too limited supply of steam has led to a decreased yield of ammonia; whereas when the amount of steam introduced was greatly in excess, and equal to from 90 to 100 gallons of water per ton, the yield of ammonia was at once raised. It is conceived that the excess amount of steam, together with the presence of a large volume of hydrogen, is required in order to protect the ammonia already produced, and prevent it from being again broken up into its component gases, as we know is the case when it is subjected to temperatures higher than about 900° to 950° Fahr.

To obtain, therefore, a really satisfactory increased output of ammonia, the amount of steam necessary will yield a very large volume of ammoniacal liquor per ton of coal. In introducing such a large volume of steam, the temperature condition of the coke may be so altered as to effect the production of water gas. One other point is noticeable—namely, that it is extremely probable that the ammonia evolved in the lower part of the retort will be to some degree destroyed when passing through the zone of higher temperature necessary for the gasification proper of the coal, and which is a higher temperature than is present in shale retorts. It may be concluded that the conditions under which ammonia is produced from coal require to be carefully studied, more especially where the process is carried out in the same retort in conjunction with making coal gas.

Charging and discharging of through retorts from one side only of the bench in gas-works of medium size is gaining favour; the economy of plant and structure which the system at once admits of is a strong recommendation for its adoption. The tendency to depart from back-to-back retorts, and instal "throughs," is worthy of note, as in one conception, it is in keeping with the trend of change in another direction—namely, the use of common splint coal to produce a 16 to 20 candle gas, and the abolition of cannel coal. Using the latter material for gas produced, it was held that, even where two ascension-pipes were in use, the tendency for the gas to go up one pipe only caused depreciation in the value of the illuminating constituents of the gas, by these latter having a considerably longer time-contact with direct heat from the walls of the retort. How far this idea of things may have proved to be the case, it is very difficult to certify; but that such reactions of dissociation of hydrocarbon bodies will take place is accepted. This aspect, however, of the carbonizing of coal in through retorts is subject to considerable alteration, in view of the greater attention now being bestowed on the conditions of working inside the hydraulic main, with the object of relieving back-pressure inside the retort. Installations of plant, it will be seen, permit of the charging and discharging of retorts from one side of the bench only; and this means a very great deal. The machines are on one side of the retort-house, with coal breaking, elevating, and storage plant; and the handling of coke, by whatever system effected, as also the producer, is on one side of the bench only. It is hardly necessary for one to analyze the effect of such a system, except to emphasize the economy in capital outlay and in working expenses; and these must appeal strongly to those responsible for good results in retort-house practice. As to whether the machines for charging and discharging should be of the combined form, is a matter largely of opinion; but, personally, separate machines for the operation are preferred. While this increases the first cost, they are likely to be more convenient to work; and in the event of sudden breakdown of the travelling gear, the one or the other operation would still be possible.

As regards the discharging of coke by machinery from a 20-foot retort, the practical success of the operation, having regard to the character of the coke produced from Scotch splint coals, is open to some degree of scepticism. Dealing with coke made from coking coals and nuts, there would be no difficulty. Using non-coking coals, the coke, having a percentage of breeze among it, may not be found to be so successfully dealt with, as the pieces of coke in the aggregate mass will certainly have the tendency to exert an individual movement in heaping up, instead of the mass moving forward as a whole. This criticism is ventured because, while machine discharging is successful to perfection when dealing with English coke, it does not necessarily follow that it must be so with all classes of coke, having regard to physical characteristics; and if non-success is met with in some instances, it may have the effect of somewhat limiting our choice of coals.

Attention may be directed to a useful piece of apparatus lately introduced into carbonizing practice—namely, the retort-house governor. The object is to bring about an increased yield of gas per ton by admitting of a minimum seal on the dip-pipes—as low as ¼-inch; an even and regular exhaust being at all times possible, with conditions of varying production of gas from the retorts. While more constant, and less alterable, conditions of a minimum seal on the dip-pipe are thus secured, it appears to me that oscillation, even in slight degree, must still have its effect on the yield of gas. There is another point in favour of the governor which ought to be taken special note of. It has been experienced on occasions, when the holders were full and gas-making operations had perforce to cease, that, owing to improper regulation of the exhauster, producer gases, and possibly air also, have been drawn in, with results the reverse of satisfactory. It is understood that the use of a retort-house governor would meet such a set of circumstances, and act as a preventive. I have found considerable advantage in having the steam-regulator governor of the exhauster controlled by a gas connection taken direct off the foul main near to the hydraulic main. The working conditions in the hydraulic main thus control the speed of the exhauster; the conditions of working in the hydraulic main being constantly noted on a registering chart—the instrument being connected by a 1-inch pipe from the hydraulic main.

Several devices for removing the seal from the dip-pipes of each setting during the period of gas making and restoring it before opening the retort-lids have met with practical success, and are undoubtedly on the right lines. This arrangement goes a little farther than the duty done by the retort-house governor; and by doing away with a seal, the effects of oscillation on the gaseous product inside the retort are removed. It is probably the case that the adoption of both a retort-house governor and a seal-dispensing device will form the most satisfactory arrangement to meet all circumstances. As a prominent member of our Association has recently patented a seal-dispensing arrangement, we may hope to have placed before us practical results from its use. Both appliances just referred to are not limited in use to large works, but are equally advantageous to those of medium and small sizes.

### PURIFICATION.

Referring to purification, and in the matter of economy, distinct progress has been made in reducing costs per 1000 cubic feet; and this in large measure is due to the more general and extended use of oxide of iron. It should not be overlooked that, with certain coals, it is possible to employ oxide only, permitting the small proportion of carbonic acid—from 1 to 2 per cent.—to pass forward as being of negligible amount. This doubtless accounts for low purification costs in some works compared with others; costs per 1000 cubic feet varying from 1·25d. down to 0·1d. Where, however, the coals being dealt with contain a large amount of calcareous matter, the percentage of carbonic acid is such that it must be dealt with by lime. The major portion of the coal used at Alloa gives a large percentage of carbonic acid in the foul gas; and if the use of lime be omitted, observation has shown the quality of the gas to exhibit the technical difference between illuminating power and illuminating effect. When carbonic acid has to be dealt with, and where oxide alone is the purification agent, careful consideration should be given as to whether the economy is not too dearly bought, in view of loss of illuminating value, which may, or may not, be required to be made good. It is a point of note that the gas-works in Scotland which sends out the lowest quality gas shows almost the largest cost of purification per 1000 cubic feet; and this presumably is owing to the use of lime.

In revivifying oxide *in situ*, practice varies; but most satisfactory results are obtained by the addition of a small quantity of air, up to 2 per cent., drawn in at the foul main (where, the gases being hot, a carburetting effect of the air results), and by the careful regulation of the temperature of the material in the boxes from 60° to 65° Fahr. by the admission of steam. After shutting off purifiers, I am not in favour of injecting large volumes of air. This method is doubtless fraught with considerable danger, as the heat produced in the chemical action is sufficient to ignite the finely precipitated sulphur and also the light tarry products which accumulate in oxide to an appreciable extent after frequent use.

### NAPHTHALENE.

It is worthy of attention that the troublesome enemy of distribution—naphthalene—while almost wholly native to England, has during the past few years made itself apparent in greater or less degree in several gas-works in Scotland. It is therefore of peculiar interest that we should endeavour to note what changes have occurred in our practice, either of manufacture or use of coal, that can be said to point to the origin of its presence in our works plant and outside mains and services. From experience, I am led to make the following observations. One is reminded in the first instance that a general lowering of illuminating power, as the logical result of changing methods of illumination, has taken place; and with a large variety of splint coal at our disposal, these have been used in greatly increased quantities. It may be noted, as a point of resemblance to experience in the South, that the quality of gas yielded by the coals in question varies from 12 to 20 candles. It was observed that, under usual routine working conditions as regards carbonizing and condensation, naphthalene made its appearance in choked lamp-services; consumers' service-pipes showing similarly almost immediately a change of coal had been resorted to, and one particular coal alone was being employed. On changing back again to coal formerly used, and adding more enrichment, the naphthalene gradually disappeared; and by way of experiment when the faulty coal was again carbonized, the same result followed with the greatest nicety. This occurred in my experience with at least three coals in the form of coking nuts, all giving a low illuminating power gas (probably about 14 candles), and in each instance Fife splints. The nuts produced a gas deficient in tars. It would appear that only a comparatively small number of coals are likely to cause naphthalene trouble, and these chiefly from one mining area. Works that are so placed as to require the use of coals producing

naphthalene will doubtless take advantage of one or other of the processes that have been found so successful in eliminating this product.

### NITROGEN IN COAL.

Attention is directed to the valuable paper recently contributed by Mr. James M'Leod, of Glasgow (now of Kirkintilloch), to the proceedings of the Society of Chemical Industry, on the redistribution of nitrogen in coal when carbonized. The feature brought out in the paper, which is of more immediate value to users of splint coal, is the varying values of the different coals in the percentage of nitrogen; and to those manufacturing sulphate of ammonia this is most important.*

Taking the maximum and minimum nitrogen content of the very complete list of coals tested—and, by the way, each coal is named—and assuming that the physical condition of the coal and temperature of distillation are such as not to cause any material effect on the amount of nitrogen in the different coals as ammonia for sulphate making, the difference is 35 lbs. of sulphate of ammonia as a maximum, and 17 lbs. as a minimum. This, as a matter of course, accounts for the varying amount of sulphate of ammonia produced at different works, and is not to be confused with efficiency of plants. Taking the present selling value of sulphate of ammonia, and deducting manufacturing costs, each pound of sulphate of ammonia per ton of coal is equal to 1d. approximately; and it would prove an additional guide in determining the buying of coals if the printed analysis showed the available ammonia, stated as sulphate of ammonia in pounds per ton.

### DIFFERENTIAL RATES.

The advent of suction gas as a competitor for power requirements has, doubtless, led to a revision of prices in many towns. In considering this phase of our business, there is involved the principle of differential rates; and it would be well if uniformity of opinion on this question would prevail. In my opinion, the principle admits of no adverse criticism, and this despite the ardent and felicitous arguments of Mr. Thomas Newbigging, in a most remarkable paper contributed two years ago to the Manchester District Institution of Gas Engineers. The statement has been put forward that it is eminently wrong to favour one consumer at the expense of another, which is a perfectly correct view to take. But it is a simple matter to show that, in instituting a much reduced price for power and industrial requirements, the gas undertaking is thereby making a substantial profit, and therefore helping to reduce the capital costs per 1000 cubic feet, and thus in turn assisting the lighting consumer.

The subject is too comprehensive for detailed consideration in the time now at disposal; but, to put the matter tersely, competition is with us and around us, for the valuable day-load factor, and must be met where possible. With a comparatively low selling price of gas in Alloa, together with a low capital account, and having regard to the variety of industries in the town, the opportunity presented for reduced rates for power users was most favourable. The undernoted statement shows the charges applicable to gas used for power and industrial purposes as a day consumption.

| | Costs Applicable to Total Gas Made. Per 1000 Cubic Feet. | | Costs Applicable to Gas for Power. Per 1000 Cubic Feet. | |
|---|---|---|---|---|
| Coal and oil | 13·77d. | | 13·77d. | |
| Purification | 0·07 | | 0·07 | |
| Wages | 3·50 | | 3·50 | |
| | | 17·34d. | | 17·34d. |
| Repairs and furnishings | 0·94 | | 0·47 | |
| Retorts and bricks | 0·69 | | 0·69 | |
| Cooking-stoves | 0·16 | | — | |
| | | 1·79 | | 1·16 |
| Meters | 0·98 | | 0·14 | |
| Pipes | 0·82 | | 0·21 | |
| Wages | 1·75 | | 0·33 | |
| | | 3·55 | | 0·68 |
| Taxes | 1·33 | | 0·33 | |
| Salaries | 0·97 | | 0·16 | |
| Miscellaneous | 0·29 | | 0·15 | |
| | | 2·59 | | 0·64 |
| Gross cost | | 25·27d. | | 19·68d. |
| Less residuals | | 6·67 | | 6·67 |
| Net cost | | 18·60d. | | 13·01d. |
| Add capital charges— | | | | |
| Interest | 2·58d. | | 0·86d. | |
| Sinking fund | 3·72 | | 1·24 | |
| | | 6·30 | | 2·10 |
| Total net cost per 1000 cubic feet | | 24·90d. | | 15·11d. |

It will be observed that the rate of 1s. 6d. per 1000 cubic feet admits of a clear profit. The selling rates for power and industrial requirements in practice at Alloa are as follows (the lighting rate being 2s. 2d.): Consumption per annum, up to 400,000 cubic feet, 2s.; from 400,000 to 750,000 cubic feet, 1s. 10d.; from 750,000 to 1,250,000 cubic feet, 1s. 8d.; from 1,250,000 cubic feet upwards, 1s. 6d. per 1000 feet. In determining the above figures (which are subject to revision as regards reducing the consumption necessary for each of the rates), recourse was had purely to competition from suction gas. The large consumer is entitled to the greatest consideration, firstly, because of a more regular and constant demand throughout the year (thereby making himself of greatest advantage) during day hours; and, secondly, because his requirements are such that he is in the best position for considering the other form of power. A flat-rate for gas, in my opinion, does not meet the case so satisfactorily, except that it is in keeping with a doctrine of equality, which may be correct from an academic point of view, but is not so commercially.

As showing the influence of an increased demand for gas, other than for lighting, and which does not raise the maximum demand, or peak-load, in December, it may be mentioned that the aggregate increase at Alloa has amounted to 30 per cent., and the maximum day output only 6 per cent. during the past five years. The capital per million cubic feet of gas made has receded from £364 to £331, and the capital per 1000 cubic feet made from 7s. 3d. to 6s. 7d., in the same period.

### GAS-FIRES.

Regarding gas-fires for domestic use, the benefits to private households are now sufficiently declared; and herein lies a vast field for the increased consumption of gas. The policy of fitting free and simply hiring out (or hire purchase) has so far met with a certain amount of success. The increased efficiency obtainable from the later patterns of fires put on the market, having controlling air and gas adjustments, is warmly welcomed. It is satisfactory that, in cases where intermittent use only is required, gas-fires are looked upon as a *vade mecum* of household management. In considering what concessions are necessary in order to have gas-fires more universally adopted—and for constant requirements, the present rates for gas may be considered somewhat high in the light of economy—it is perhaps well that a question of this kind should not be too hurriedly decided; but until a lower selling price than is at present generally available can be given, gas for heating cannot become so freely used as is desired. One may venture to assert that the gas industry at this moment is in want of a cheaper measuring instrument, and one quite as reliable as the ordinary form of meter with which we are familiar. If gas used for fires is to be supplied at a discount or lower rate, a second meter will be necessary. The growth of the penny prepayment meter supply has been such as to cause an enormous capital outlay by gas authorities, and this to serve a class of customer providing as a return a comparatively low average annual consumption of gas. In the case of many towns, the increased use of gas, and the direction in which extension of business has been chiefly fostered, have required the introduction of slot-meters. The annual consumption from slot-meters in some towns is as low as 6000 cubic feet, and generally varies between this figure and 16,000 feet; and consumers are taxed by an extra charge of anything from 4d. to 1s. per 1000 cubic feet.

### STREET LIGHTING.

The efficiency of gas for illuminating public streets is now fully recognized. Electric light will continue to have its advocates; but it is important to observe, in looking round, that local authorities are now curbing their desire for too great capital expenditure in displacing gas by the arc lamp. The writer is familiar with a town of modest population where the total cost for electrically lit thoroughfares amounts to £440 per annum for a mile of street, while incandescent gas is responsible for 12 miles at an inclusive cost of £796 per annum. Referring to statistics, it is found that, while in 1903 there were 83,216 public gas-lamps in Scotland, this number in 1906 had increased to 87,295; and of these the number of incandescent lamps increased from 17,977 to 52,530.

The application of the inverted type of burner in street lanterns has been in successful operation; and when a consumption per hour of about 2¼ cubic feet is required, this burner meets the situation. But my experience has shown that, where a consumption of about 3 cubic feet per hour can be afforded, the upright burner gives as satisfactory an all-round result as is desired. The inverted burner in practice may be said to be more sensitive to varying conditions of pressure; and an inverted burner not fitted with a gas and air regulator cannot be considered satisfactory. For this reason, I have for street lighting had to discard inverted burners which were not fitted with an adjusting arrangement. While on this subject, those responsible for the manufacture of inverted mantles—perhaps the responsibility is with the makers of burners—would do well to standardize inverted mantles, and have them suitable for all requirements.

### PROPOSED COMMERCIAL SECTION.

An attempt is being made to form a Commercial Section, so as to, in part at least, if not altogether, control the price of bye-products. Influencing the price of sulphate of ammonia cannot, I fear, be possible, owing to the number of sources from which the production of this material arises. It would require very wholesale unanimity of opinion over a wide area, but is possible in some degree where local demand is considered.

The coke market offers the greatest amount of success in endeavouring to come to a general agreement as to prices among sellers. But this again must be limited to suitable local areas. The disturbing factor, however, appears to rest with the very large works, in the eastern and western area, which produce such enormous quantities of coke that their local demand is quite unable to absorb what is necessary to dispose of; and therefore, in order to clear their stocks, they require to invade all parts of the country—paying large railway dues to permit of disposal. We must all be at one in recognizing the advantages of a section such as has been proposed, and the present is the crucial moment for its operation.

* See "JOURNAL" for March 19, p. 748.

### THE JUNIOR ASSOCIATIONS.

The Junior Associations are fulfilling an important duty to the younger members of the profession. One feature of their work cannot fail to attract observation—namely, the system of visiting manufacturing works—not only gas-works, but those of kindred industries. Practical tuition of this kind serves to broaden the mental grasp, and is an acknowledgment on their part of the close relationship of one manufacture with another. One thing is eminently true, and it is matter for sincere congratulation—that the education of the future gas manager is not haphazard, unduly routine, but systematic; and taken all-in-all, the status of the profession is well assured.

### THE AFFILIATION QUESTION.

It might be preferred that the question of the affiliation of Gas Managers' Associations with the Institution of Gas Engineers should be left in further abeyance so far as Scottish gas managers are concerned. This, however, is not possible. The affairs of a common industry are linked together by the same bond that knows not any border-line of geographical position; and we are not serving our own interests if we refuse to take our share in moulding and directing the legislative changes in gas supply that must inevitably affect us as time moves apace. In joining with the Institution, the name of the Association is retained; and its management and financial arrangements remain under the control of the Association. If desired, the relations caused by affiliation may be terminated at any time by giving suitable notice. In affiliating, the membership of each Association is not affected, either as regards associates or others having a general interest in gas affairs. There may be a certain kinship possible under the flag of one's patriotism, but I am out of patience with anyone who seeks to idly discuss this subject in such a spirit. The resources of the gas industry must not be taxed with the trammels of domestic differences.

### RESEARCH AND INVESTIGATION WORK.

The informal nature of our meeting renders free the opportunity of mentioning a matter I have always felt we, as managers of industrial works, acting in unity as an Association, have done nothing to create. I refer to research and investigation work. Possibly the want of sufficient enthusiasm, or of mere application, or the absence of right minds acting together, has caused a stationary attitude. It is perfectly true that work of a pioneer kind cannot be done without money; and it is also true—and the truism is most remarkable—that the best work has been done, not by a constituted number, but by the individual. We can quite well leave the higher research to Associations having the necessary amount of funds; but I do feel that a formal meeting in July and an informal one in April do but scant justice to ourselves, and render insufficient return in benefit to the industry at large.

We know how much we are indebted to the Technical Press for diffusing valuable information on all manner of subjects; but it, again, only reflects and records the work of the individual or corporate body. With plenty of will, there will be an abundance of opportunity; and as a nucleus for a beginning, there is the long inert Research Fund of the North British Association, which is fasting itself on the meagre return of common bank interest. I, therefore, direct the attention of the Committee of that Association to their responsibilities; and we shall look for results.

### ILLUMINATING POWER.

It is hardly possible to conceive an open address to a meeting of gas managers that does not refer to the subject of the illuminating power of gas. I have already discussed this matter at considerable length in a paper contributed to the proceedings of the North British Association in 1904. The present opportunity, therefore, may be taken to observe the distance travelled in the direction of reducing the quality of gas. Shortly stated, the result of the movement throughout Scotland in lowering the illuminating power of gas—and by this is meant that enrichment by oil and cannel is being gradually departed from—is that gas-works are confining themselves in greater measure than before to the use of splint coal only. The change in quality of gas supplied has been gradual, and advisedly so, and may be said to be coincident with the extended use of incandescent lighting. Works that a few years ago were supplying 25-candle gas, are now sending out gas of 20 candles. Glasgow has reached a standard of 18 candles. In regard to the future, as already observed, splint coals procurable from the several coal-producing districts yield an illuminating gas of from 12 to 20 candles, and consequently between these limits will the illuminating power of gas in most towns be fixed. Thus the change will come about in short process of time, and will be decided by no arbitrary law of custom and practice as in the past, but by adherence to the economies of commercial practice. With the present upward tendency in the price of coal, the time is opportune for each one to reconsider his policy in this matter.

### CONCLUSION.

I have endeavoured to bring before you in general, rather than detailed, manner several of the more salient aspects of our business, and have left to the conscious care of each one the looking after of the little, but not unimportant, points of practical working that go to form success. Nevertheless, the field of discussion is broadened beyond the scope of this address; and in closing, I desire to thank you sincerely and well for the honour you have conferred in appointing me President on this occasion,

### *Discussion.*

Mr. M'Lusky said he had great pleasure in moving a hearty vote of thanks to the President for his address.

Mr. J. W. Carmichael (Barrhead) seconded.

The President, in returning thanks, said the address was quite open for discussion. He had made it perfectly certain that some points would be raised which were of a nature likely to create difference of opinion; and he was quite sure they had present with them that day gentlemen who were in a position to discuss the more important problems of gas manufacture, as judged by their own experiences.

Mr. J. Napier Myers, referring to the subject of purification, said he was one who had been depending almost entirely upon oxide of iron; but the only good thing he could say for the practice was that it was economical. By this method of purification they allowed about 2 per cent. of carbonic acid to go forward, and perhaps as much air; so that they had from 4 to 5 per cent. of inert matter in their gas, which was not previously there, and for which no rebate was given to the consumers. However, he believed the practice to be quite economical and profitable; and this was its justification. He had noticed, in his practice, several changes in the character of the gas—changes which he could hardly account for. In the purifying house there was a deposit of hydrocarbons—an oily matter was noticeable in the water lutes, and also in the bottoms of the boxes. He knew that, if this oily matter were there, it could not be also in the gas; and, consequently, the gas was being robbed of some of its hydrocarbons. Another matter which he had observed was that the iron was carried forward in the gas; and that its presence was noticeable in the tubes of the pressure gauges. There was a discoloration of a reddish matter. He found the same in the tanks of the gas-holders. There was an irony matter which deposited upon the rivets and the sheeting of the holders. He was formerly in the habit of painting his holders white, and endeavouring to keep them as clean as possible, with a view to lightening their appearance, and consequently increasing the capacity of them, as they would in this condition be able to radiate heat, and were not subject to the same absorption of the heat of the sun's rays as when they were darker in colour. But he found now, since he had adopted purification with oxide only, that he would require to use oxide of iron paint, and consequently have darker holders, and holders which would contain less gas. If the President were able to throw any light upon the subject of why oxide of iron was carried forward in the form of dust in the gas, and was deposited in the process of manufacture, he should be very pleased.

Mr. T. Wilson (Coatbridge) pointed out to Mr. Myers that if oxide of iron left carbonic acid in the gas, they added an enricher, in the shape of benzol, which fully made up to the consumers for the loss in illuminating power due to the presence of the carbonic acid.

Mr. D. Vass took the same view, and said he would prove his position by figures. Purification by oxide of iron would cost about £1 per million cubic feet. If they had a works producing 50 million cubic feet of gas a year, purification would be accomplished for between £40 and £50 a year. With lime, the cost would be something like £200; and the £150 saved must go somewhere. A little of it might be spent in enriching, to overcome the small quantity of carbonic acid that went forward in the gas; but he was certain that all the £150 was saved to the consumers and the owners of the undertaking—perhaps half to each. He was afraid that painting gasholders with oxide of iron would not end Mr. Myers' trouble. He found the deposit, but attributed it to the enriching material. He did not think it would be removed by going in for another paint. It might be a little tar going forward in the gas. It did not show so readily with lime as with oxide of iron. He would be glad if anyone were able to throw light on the matter. The figures given in the address as to the cost of purification were very instructive. They had the cost given as running from 0·1d. up to 1¼d. He thought there was considerable room for research there—systematic research, such as one gas manager could not overtake. If any gas manager tied himself down to purification with oxide, he had not the opportunity of comparing his results with those from lime purification; and in many works they could not have the two, side by side, to experiment with. This was why he thought the Research Committee of the North British Association should step in and appoint a chemist to make independent tests of gas after passing through oxide of iron and after passing through lime—both with and without revivifying *in situ*. He had been told of one gas-works where lime was used, and where revivifying was employed; and it was claimed to be successful, under what conditions he could not say. But if it were possible for one man to do this, it was possible for another to do so. The amount of saving which would accrue in Scotland if everyone were able to reduce the cost of purification to ¼d. would be something enormous. It would be thousands of pounds; and he thought that an expenditure of £100, in the form of research, would be quite justifiable.

Mr. S. Milne (Aberdeen) said, with reference to oxide of iron, he remembered, in a small experimental works where they were making tests of coal, passing gas through oxide of iron, and they got a very peculiar deposit upon the gauze of the platinum burner. The deposit increased from day to day, until it entirely closed up the gauze top. It was of a black, hard substance. Perhaps the President would say whether or not he had experienced the same. About a month ago he changed his system of working purifiers. For very many years they had been using both lime and oxide of

iron in Aberdeen, introducing the lime in the bottom tier and the oxide of iron in the middle and upper tiers. He had reversed this arrangement, and now introduced the oxide in the bottom tiers, and the lime in the top one. One reason for this was that they could get a greater depth of lime. Another reason was that, so far as he could ascertain, theirs was the only works in which purification was being done in this way. Another thing that commended it was that, as the lime had to be removed to carts or waggons at the side of the purifying vessels, the men were now saved considerable exertion in throwing the lime out, as compared with what they had when it was in the bottom tier. His experience was that, whereas previous to the adoption of the new arrangement the oxide became wet and inactive, it was now found to be dried up and in the condition in which it should be. A few weeks ago—they proceeded cautiously in the North—he commenced, for the first time in the history of gas manufacture in Aberdeen, the introduction of about 1 per cent. of air into the gas. With 1 per cent. he had found no falling off in the illuminating power; and with a make such as they had, 1 per cent. represented a fairly large sum of money at the end of the year, when it was sold as gas. The subject of the amendment of the Sale of Gas Acts, in regard to the testing of meters, was under consideration just now; one suggestion being to limit the percentage of error to very much below 5 per cent. The subject was discussed there two years ago, and he thought that some held very strongly that 5 per cent. was a ridiculously large range for error, when meters could now be made so perfect. He did not think that anyone holding this opinion had had very much to do with the making of meters. He was strongly of opinion that 5 per cent. should not be departed from. He had dry meters from nearly all the best makers in the country, and, without exception, they all required very careful attention to keep them within the statutory 5 per cent. range. To the consumers in the district they said that they had the remedy in their own hands, as they could have their meters tested, and the Corporation would pay the fee if they were inaccurate. When consumers knew that the fee was only 6d., they did not hesitate to have the test. In a large number of cases the meters, unfortunately, turned out to be either fast or slow, and certainly beyond the range of 5 per cent. Another suggestion was that meters should be tested periodically—every five or ten years. It might be well, as the subject was at present under consideration, to have some expression of opinion upon it there. Personally he favoured the retention of the 5 per cent. range, and periodical examination every ten years. It might be of interest to others to know, with reference to dry meters, that for the past three years he had been in the habit of testing dry meters for partial indication. The inspectors, after they had gone through their districts, had a dull time of it, and he occupied them in doing this. All they had to do was to light up one burner, and observe the test-hand of the index. If it showed a movement, the meter was passed as fully indicating or registering. But should there, apparently, be no movement, the test was continued a little longer; and if it were evident that no movement had taken place, the meter was removed to the works, to be tested more accurately, in order to ascertain how much gas could be passed before registration was indicated on the dial. If anyone had not done this, he would be surprised at the number of burners it was possible to keep lighted from a meter without registration. It was quite common to find meters arrested in this way passing from one to ten, twenty, and thirty lights, and in not a few cases passing gas with an open coupling without registration. Since he introduced this system, he had been able to reduce his unaccounted-for gas from 8 or 10 per cent. to about 5 per cent. He attributed this not to any improvement in the mains, but solely to the attention they paid to dry meters.

Mr. J. W. Carmichael reminded the meeting that the question of the use of oxide of iron had been discussed by them over and over again, and they did not seem to be getting any further forward with it. It had occupied their attention for years; but he thought that the President had explained in his address a way of getting over the difficulty, which was by utilizing the Research Fund of the North British Association, in investigating matters like this that puzzled them so much. He thought the North British Association should utilize their Research Fund for this purpose, and appoint a chemist who would investigate, and enable them to know what was the cause of the discoloration upon the glasses of pressure-gauges. It was no use letting the fund lie in the bank, for bank interest only.

Mr. A. P. Main (Glasgow) asked to be allowed to say a word or two upon an aspect of the address which interested him especially. That was the question of gas for heating and cooking. There were some very interesting developments taking place in this line. Most of them would have seen that the Town Council of Glasgow had remitted to the Sanitary Inspector to report on the question of gas heating as a means of alleviating the smoke problem in the City of Glasgow. When Mr. Fyfe, the Inspector, presented his report, it should be one of very great interest to them all. Some years ago, when a large hotel was being built in London, he went to considerable expense in the matter of producing drawings, and in other ways, in support of the proposal which he made to the proprietors that they should put gas-fires into every bedroom. He pointed out the great saving of labour there would be, and the profit they would obtain from the sale of gas. When staying in the hotel a fortnight ago, he saw that gas-fires had been installed. He was told they had 1200 of them in the hotel. He was curious to see how the thing would work out in practice, and he had his fire lighted. It was a fire consuming, he should say, 14 or 15 cubic feet of gas per hour. He had it lighted for about four hours, so that the actual cost to the hotel proprietors for gas did not exceed 2d. or 3d., and the labour was practically *nil*. The charge in the bill was 1s. 6d.; but, of course, that was the charge which all the hotels in London made for a fire. So the hotel proprietors were in profit, so far as his fire was concerned, to the extent of at least 1s. 3d. This showed that what he had pointed out to them was really coming to pass. Of course, he could have burned it all night. This was a weakness in the system which, as he pointed out to them long ago, could easily be prevented. But even supposing that his fire had gone on for eight hours, the proprietors would still be a considerable sum to the good. There was another matter which was of very great interest to all gas managers. That was a department of gas cooking, which cost the gas company nothing in the matter of capital expenditure. He had been astonished, within the previous day or two, at the very large number of combined gas and coal-ranges which were being fitted in Glasgow and other towns. He should say that, in Glasgow, it was only within a couple of years that the matter had really been seriously taken up by builders—and it required a good deal of pressing to get them to do it; but now it had been started by the leading builders and architects. It had been pointed out to them that after they had been to the cost of building in a coal-range in a new building, the first thing the occupier often did was to go to the gas office and hire a gas cooker. A great disadvantage of this was that the gas-cooker had to stand on the floor of the kitchen, where there was no provision for carrying off the fumes. There must now be in Glasgow some hundreds of these combination coal and gas ranges put in by the builders. They were there for all time, and they had not cost the Gas Department one farthing, in any shape or form. He mentioned this because it opened up a most interesting field of development; and he was quite sure that if gas managers would watch new buildings, and point out that it would be far better to give the people what they wanted, and not what custom had long ago prescribed, they would get a very large increase in their gas consumption without any capital expenditure whatever.

Mr. W. Fairweather (Kilmarnock) corroborated what Mr. Main had said with regard to combination fires and cookers. In Kilmarnock they had adopted this system—not on a very large scale, but a considerable number of these combination arrangements had now been in operation for some years. One builder in particular had put the arrangement into every building he had erected, and, so far as he had heard, it had given every satisfaction. It was a very wise arrangement, indeed, because unless special arrangements were made in a building when it was being put up, the chances were no gas-cooker would go in there.

Mr. L. Hislop (Uddingston) said he was very much struck with the remark of Mr. Carmichael, with regard to the employment of a chemist in connection with the Research Fund to test what was the deposit in the gauges. It was admitted that they had among themselves one or two very expert chemists—he might mention Mr. M'Leod, of Kirkintilloch, and also their President; and as gas managers were not so very much pressed for time at some seasons of the year, he had no doubt but that they might spare an hour or two to carry out some experiments themselves, and the Research Fund might bear the expense. To employ an outside chemist would be a costly matter, as had been experienced by an Association in the South. It would require very much more than their Research Fund could bear. The President spoke of a constant endeavour to obtain the largest possible yield of gas, and that this determined the value of coal. He thought a great many other points had to be taken into consideration besides the yield of gas. At a later stage in his address, the President remarked that some coal gave 17 lbs. and others 35 lbs. of sulphate per ton. This was a difference, at 1d. per pound, of 1s. 6d. per ton of coal. One coal would give them 4 cwt. of coke more than another, and this coke might be value for anything from 6d. to 9d. per cwt., which meant another 3s. per ton of coal. Therefore, if they put these two items together, they were, perhaps, of greater value than the yield of gas. The President noticed also vertical retorts. The President had had shale-works practice; and he told them that the cost of carbonizing was 3d. per ton. He (the speaker) had the pleasure of being with the Western District Junior Association at the Philpstoun Oil-Works; and the cost of carbonizing was given at 8d. per ton. Perhaps the President would tell them what oil-works were in a position to carbonize at 3d. per ton. A few months ago he visited England, and he thought he saw every kind of machine in use for charging and discharging. He saw the Fiddes-Aldridge—one of the combined machines—at Liverpool; and it was doing very good work. He considered there was room for a machine of this kind, which would give them a smaller capital expenditure and even better results than some of the machines in the market at present. With reference to the retort-house governor, those of them who were at the Manchester District meeting the other week, and heard the paper and discussion there, were pretty wel convinced that there was something in the retort-house governor. There were three gas works in Scotland—Perth, Dundee, and Stirling—in which the system was being adopted; and he had no doubt that before July there might be some facts known which would be of interest to the profession. He would have liked to have heard Mr. Thomas Wilson, of Coatbridge, tell them as to the deterioration of the candle power he got through not taking out the carbonic acid from his gas. For the last year or two he had

been making a study of the matter; and he found that, with an average of 3 per cent. of carbonic acid, there was only a difference of about half-a-candle. Of course, the carbonic acid was to a certain extent carburetted, which might account for it. If this quantity of carbonic acid was introduced after the gas was purified, the loss in illuminating power would be greater; but when it was only used as a carrier, it did not seem to make such a great difference. The President also spoke of coal analysis and the estimated amount of ammonia. He should think it would be difficult, in a laboratory test, to settle this amount, because they had no appliances, in the shape of scrubbers or washers, to give them the results such as they would have in actual working.

Mr. W. B. M'Lusky thought they were all agreed that the advance in the price of coal was inevitable, so far as the ensuing year was concerned. The price would be firmer in some districts than in others. For instance, in Fife facilities for shipping were good, and the coal there had peculiar characteristics, which operated in a wide field, for trade purposes, though they did not produce a coal of inferior value for gas making. For sulphate of ammonia, the average of Fife coal was 17 lbs., as against 35 lbs. for Hamilton coal. He had had the privilege recently of seeing some of the latest types of retort-house machinery, notably the new form of the De Brouwer and the Fiddes-Aldridge machines. At Derby, he saw the discharger at work; and he had not seen a finer example of retort discharging. One beautiful feature of the operations was that the overseer was able to determine whether the charge was properly carbonized or not, because the whole section of the charge was exposed to view at the discharging end. He had not, as in the ordinary case, to make a very careful examination, to find out whether the non-carbonized pieces came from the top, the bottom, or the middle of the retort. As to the seal displacer which Mr. Ewing, of Greenock, had patented, he thought he was to be complimented upon it.* In his opinion, it was in advance of anything in this country or on the Continent. The gas supplied in Glasgow was of 18-candle power; but that was with a flat-flame burner. The 14-candle gas which was supplied in the Metropolitan area, was only of 9-candle power with a flat-flame burner; so that Glasgow had to come down a long way before the gas supply would be the same as in London. In Perth, with a "Metropolitan" argand burner, which they got in their last Act of Parliament, they obtained a 21-candle standard with a very ordinary gas, and they reckoned that this was equal, under conditions the most favourable to the consumer, to an 18-candle standard with a flat-flame burner. At other times, however, they might have a gas coming forward which would test at 21 candles in an argand burner, but would only test at about 15 candles in a flat-flame burner; and they might have the same gas giving a test of 20 candles with an argand and of 14 or 15 candles with a flat-flame burner. They could therefore understand that it would not be safe to test in Scotland with the argand burner for the consumers' supply, because they might have it at a 20-candle standard with the argand, and probably at an 18-candle standard with the flat-flame burner; and two or three days afterwards, testing with the argand, they might have the same standard, whereas the gas might have fallen two or three candles in the consumers' flat-flame burners. He believed that the employment of gas for heating was more important than its use for illumination. They got more complaints from a fall in calorific value than from a fall in illuminating power with the flat-flame burner. Their test, for gas of the quality he had mentioned, was about 700 B.T.U.; but it took a very good coal to give 700 units, with an illuminating power of 21 candles with the argand burner. This was, however, a gas which was very suitable for fires and cookers; and certainly it was equal to any of the cannel gas they had had in Scotland, for the purpose. Mr. Hislop had made a few remarks about coal buying, and they recognized that Mr. Hislop's father was the greatest authority they had in regard to this matter. In his own case, he found the price to range from 7s. 6d. to 10s. per ton. After they recovered the residual products, the net cost of the one coal was found to be 1s. 11d., and of the other (which was sixth on the list) 6s. 2d. per ton. He did not know if there was any town in Scotland which had been so well exploited in the gas-fire trade as Perth. They had, at the present time, 7000 cooker and fire connections. Five years ago they had only 8000 consumers; and during the past six years they had increased from 6000 odd to 10,000 odd consumers. The remarkable thing was that they obtained most of these consumers for lighting after they got them for gas-fires. There was one point which had not been touched upon that day—that was gas lighting. Probably there was a very good reason for this, in that there was really no competition with gas as a lighting agent. About eighteen months ago, he read a paper before the North British Association, upon "Gas in the House," in which he submitted a scheme showing what might be done in the way of distributing fittings in towns. His Committee had now applied the scheme. They had had a full year's work of it, with results which had exceeded his anticipations. They had got back a great many consumers who had gone in for electric lighting; and they had obtained a staff consisting of all the gas-fitters and ironmongers in the town. He had found this system to have a most beneficial effect upon the gas business generally.

Mr. Allan Reid (Brechin) referring to the proposal to form a Commercial Section, said he was rather disappointed with the discussion which took place upon the subject at the meeting of the North British Association last July. Managers of small works were feeling the pinch of the competition in residuals as much as, if not more than, the managers of larger works. He wished to throw out the suggestion that, when they were considering this matter, if they came to little areas, the small works should be thought of. In his works, a little over 30 million cubic feet of gas a year was made. Last year he was severely run for coke, and applied to a works not very far away for a supply, which he got at 7s. 6d. per ton at the works. Within a few weeks after this, they were selling coke at the works for shipping at 3s. 6d. per ton. Being in a small concern he could not help himself, and so he had to pay the higher price.

The President said it was with considerable feelings of distrust on his own part that he ventured to construct an address which would be open to discussion, because, as all were aware, points of difference must arise—and he knew of no industry which presented such variety in the matter of points of difference as did the gas industry. He was satisfied that the discussion which had taken place had been an ample reward to him for the trouble he had had in preparing his address. With regard to the matter of coke, he understood that the Committee of the North British Association had resolved to go into the matter in a thoroughly practical manner, and he hoped that something satisfactory would come to fruition from their labours. His own opinion was that, in so far as they had certain areas in which there were placed large works, producing enormous quantities of coke, each works had a difficulty to face in the disposal of its output at a satisfactory price; and if the export were at such a rate that a loss in value resulted, then the only other principle was that of dividing the quantity produced all over the country, and this perhaps would be the difficulty in the matter. Mr. M'Lusky had emphasized the great importance which they, as managers of industrial concerns, ought to place upon the buying of coal. They all knew that in the past the volume of gas produced and the illuminating power had obtained precedence; and in his address he attempted to bring out the values of the bye-products—coke, sulphate of ammonia, and tar—and that this was a subject of very pressing importance indeed, more especially at the present moment. The matter of purification had been mentioned; and it would appear that the lines on which most people were going were now pretty well defined. But there was to be remembered that, so long as they had varieties of coal, they must have varying quantities of deleterious matters in the gas; and so long as this was the case, the cost of purification per 1000 cubic feet obviously must vary. Regarding the matter of carbonic acid, he was satisfied that about 2 per cent. was allowable, so far as being negligible in depreciating the value of the gas. When they had to deal with a coal yielding 4 or 5 per cent. of carbonic acid, the necessity for using lime was at once apparent; but in comparing the results of to-day with those of purification a number of years ago (when, in his own experience, they were able to pass about 70 million cubic feet of gas through a 20-feet purifier, and shifted only four boxes per annum), certainly not much more in the way of satisfactory result could be expected. Regarding the testing of gas-meters, he was inclined to view the testing of them by themselves as being the most satisfactory method, notwithstanding anything which the Board of Trade might do in the matter of insisting upon an official test being made within a matter of five or ten years. He did not wish to emphasize unduly the opinions he held regarding the Research Fund of the North British Association, as he had already stated, somewhat emphatically, that it had been inept, absolutely useless. He thought it was necessary that they, as members of a Technical Association, representatives of an industry which had far-reaching effects, not only upon themselves as individuals, but on the welfare of the country, should endeavour to do their very best in forwarding the interests of their industry; and he was satisfied, now that the matter had been ventilated, that the North British Association would do their best to have this matter gone into on a practical basis.

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Mr. M'Lusky said he had very great pleasure in proposing that Mr. George R. Hislop, of Paisley, be asked to take the chair at the meeting next year.

Mr. J. Napier Myers seconded. It was his good fortune to serve under Mr. Hislop for a time, and he could assure them that his interest in the gas industry was very great indeed.

The President expressed satisfaction at knowing that Mr. Hislop had agreed to act next year.

This concluded the business of the meeting.

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About ninety gentlemen thereafter sat down to dinner in the hotel—Mr. Napier again presiding. The toast of "Kindred Associations" was proposed by Mr. D. Macfie, of Edinburgh, and responded to by Mr. L. Hislop, as President of the North British Association. Mr. W. Blair, of Helensburgh, proposed "The Informal Meeting," and Mr. W. B. M'Lusky acknowledged.

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Mr. Basil M'Kenzie, the Manager of the reservoir works of the Swansea Corporation at Cray, has been engaged by the Water Committee of the Stockport Corporation as Manager to complete the excavations of the tongue trench and other work in connection with their Kinder scheme.

* See "Journal" for March 26, p. 825.

# MIDLAND JUNIOR ASSOCIATION.

### Visit to Leamington.

With last Saturday's visit to Leamington, the programme for the 1906-7 session of the Midland Junior Gas Engineering Association, as originally arranged, was completed (though, as has already been intimated, an "extra" has meanwhile been fixed up, in the shape of an inspection during June of the fire-clay works of Messrs. George K. Harrison, Limited). A large party arrived at Leamington shortly after three o'clock, and were met at the station by Mr. Thomas Berridge, the Engineer to the Gas Company, and Mr. J. H. Willoughby, his Assistant; and a move was at once made to the gas-works, where some time was spent in an examination of the plant. A full illustrated description of these works was given in the "JOURNAL" when the Midland Association of Gas Managers visited Leamington in May, 1905 (p. 500). The staff present were: Messrs. W. E. T. Hems, G. Rose, S. Hill, F. Watts, A. Leigh, A. Bissell, W. Hyatt, P. Tew, and J. Parker.

The works stand upon 4½ acres of land; and the present make of gas exceeds 240,000,000 cubic feet per annum—the sale being about 11,000 cubic feet per ton of 17-candle power gas. The inspection was begun at the retort-house, which is lighted on the Millennium high-pressure system, and contains three benches. No. 1 consists of 17 settings of six ⏀ retorts, 10 feet long, with horseshoe regenerative furnaces; No. 2, of four settings of six ⏀ retorts, 24 feet long, with Trinity tile regenerative furnaces; and No. 3, of six settings of six ⏀ retorts, 21 feet long, three with A.B.C. tiles, and the remainder with tubes. All the retorts are 22 in. by 16 in. Each setting has a separate steel hydraulic main, fitted with Helps's patent displacer. In this type of dry main, the dip-pipes are sealed and unsealed by the addition and withdrawal respectively of gas under pressure—usually from 4 to 6 inches of water. After passing through the condensing main, the gas enters the battery condenser (where it is subjected to a tar-bath from a series of spray-pipes, fed by a pump); and then it travels through a vertical water-tube condenser. Of the two exhausters, one is of the reciprocating type, capable of passing 40,000 cubic feet per hour; while the other is a four-blade Beale, with a capacity of 100,000 cubic feet per hour. After leaving the exhausters, the gas passes through a Pelouze and Audouin tar-extractor, a cyanide washer, the tower scrubbers, a naphthalene washer charged with a solution of benzolized creosote, four lime and two oxide purifiers (the latter fitted with Jäger patent grids), and the station meter, to the gasholders.

The inspection of the works, however—interesting as it proved—was only one item in the proceedings of an afternoon which was replete with both pleasure and profit. Assembling in the meter-house, the party were given first of all a description and practical demonstration by Mr. Bonniksen of his invention for synchronizing clocks by means of a temporary increase of the pressure in the gas-mains throughout the town. This system has for some time past been in operation at Leamington; and it formed the subject of a paper read by Mr. Berridge before the Midland Association as recently as last October (see "JOURNAL," Vol. XCVI., p. 319).

After this, Professor Threlfall, with the aid of a full series of lantern slides, explained his system for the measurement of gas; and the value of the lecture was enhanced by the fact that the members were able to inspect samples of his patent stream-gauges and gas-meters, which have been in position at Leamington for some months past. It will be remembered that Professor Threlfall presented a paper on the subject to the London Section of the Society of Chemical Industry last month, a notice of which was given in the "JOURNAL" at the time (p. 682). He told the members on Saturday that he had by means of his system measured 40 million cubic feet of gas per week for four years. He has thirteen stream-gauges in use. The total quantity of gas is first of all measured by means of a meter; and then wherever gas is taken from the main supply for any special purpose, one of the gauges is put in, so that it is possible to ascertain how much gas is being employed in this particular direction. The arrangement is also serviceable in the detection of waste. His four years' records of comparison between the total quantity of gas measured by his meter and the amounts indicated by half-hourly readings of the stream-gauges, showed that the average error was not 2 per cent. That is to say, the subdivided streams measured by the stream-gauges were equal within 2 per cent. to the quantity of gas made. He pointed out that in the case of an ordinary volume meter set to measure correctly at 60° Fahr., if the temperature rose, of course, it read too high; while if it fell, the meter read too low; and he said there was a correction to be applied to his meters of the same kind, but it was only half the correction that would have to be applied to the other meters. In concluding his description, he remarked that, if one wanted to measure a large quantity of gas, and wished to avoid the expense of putting in a big meter, gauges could be placed in the pipe. But to observe such small pressures as had to be dealt with, special instruments were required. Most of his instruments he has made himself; but Messrs. Chamberlain and Hookham have manufactured many of them.

Alderman Dr. Thursfield, a Director of the Gas Company, in proposing a very hearty vote of thanks to the Professor, remarked that such investigations as he had described could not but be to the benefit of the gas industry. In acknowledgment, Professor Threlfall referred to the apparatus that had been fixed at Leamington, and said that the result of watching it had been to leave no doubt whatever in his mind that the meter was really giving very accurate readings.

A move was then made to the Board-room, where Mr. Langdon Down, of Telephos, Limited, was waiting to give a demonstration with the latest type of the firm's electric gas lighter. The present form differs in several respects from that which was described in the "JOURNAL" some time ago. Among other things, the apparatus is now English-made right through. It may be pointed out that in the new pattern no gas enters the case below the burner which contains the mechanism; while the burner itself is fitted with a fire-proof porcelain top. The appliance certainly worked very smoothly on Saturday; and the recognized importance of arrangements which will permit of switching gas on and off, ensured for it a large amount of attention on the part of the visitors. Another object of interest in the room was a handsome "Ecliptic" gas-fitting consisting of fifteen inverted burners, and having a total consumption of about 15 cubic feet an hour.

The company then adjourned to the Crown Hotel, where, by kind invitation of Mr. Berridge, they had high tea—about ninety sitting down. At its conclusion, Dr. Thursfield proposed "The Prosperity and Welfare of the Midland Junior Gas Engineering Association," which he understood was an association of juniors who should, if they knew their own interests, all rise to something better than they were at present. Mr. Berridge had told him that there were any number of applicants for positions of £120 or £140 a year; whereas, at the "top of the tree," there were often very few who put in for a really good appointment. Mr. Berridge wished him to "point the moral, and adorn the tale," and to impress upon them that it was in their power to make themselves so proficient that the time might come when, instead of there being as now a crowd of candidates for small positions, the conditions would be just the reverse. If a man made himself capable of fulfilling the duties of the higher appointments, they might depend upon it that he would not be allowed to remain on the lower rungs of the ladder.

The President (Mr. G. W. G. Tatam) responded, and he also proposed the toast of "Our Host, Mr. Berridge." He assured Dr. Thursfield that they were all trying to get to the top of the tree, and that some of them found there was rather a crush in the middle. Mr. Berridge, with his usual foresight, said some two years ago that it would be a great aid to the juniors in reaching the top if they were able to meet together and discuss questions relating to the industry. He was not contented with starting the Association, but during the two years that it had been in existence he had on every conceivable occasion given the greatest possible assistance. A tremendous amount of the initial work connected with the Association was done by Mr. Berridge; and that afternoon he had given them a further proof of his wish to assist them, by allowing them to visit the gas-works, and by asking other gentlemen to be present to explain various up-to-date contrivances, in which they had all been greatly interested. Had Mr. Berridge simply taken them round his works, they should have been satisfied with that, because there was one thing in particular about the works that they were able to admire. That was the cleanliness and tidiness—everything seemed to be in its place. There was no lumber; and this in itself was a lesson to them, because without doubt the better a man kept his works the lower were his costs. It was therefore the right line to success.

Dr. W. B. Davidson, Chemist to the Birmingham Corporation Gas Department, said he was very glad to have an opportunity of seconding the proposal to drink Mr. Berridge's health, and of speaking to the great amount of pleasure and instruction they had had that afternoon. He also congratulated the Hon. Secretary (Mr. James Hewett) on the admirable programme he had devised and carried out for the Association; and he was sure that the visit that day would be remembered as one of the very best they had had.

In response, Mr. Berridge said he was much obliged to the President for the very kind manner in which he had proposed the toast; and he thanked them all for the way in which they had received it. He was glad they had come; and he would like also to thank Dr. Thursfield for lending them his valuable aid. He was always to the front in any good work, either in Leamington or in any other part of the country. He was obliged, too, to Professor Threlfall for coming and giving his lecture on his meter, which he (Mr. Berridge) was quite sure had a future before it. It was really past the experimental stage; and they had tried it at Leamington, and knew that it could do what the Professor said. Their thanks were also due to Mr. Bonniksen and Mr. Langdon Down. If the latter gentleman's little appliance would only work as well in the future as it had that day, it would find a place in everybody's house, and be one of the greatest competitors electricity had ever had—almost as great as the incandescent mantle. Then it was very good of Mr. Terry and his Company to invite them to go to his foundry, and to have a little drive round the country.

The party then entered the brakes which were in waiting, and drove to Guy's Cliffe, and then past Warwick Castle, finishing up at the Imperial Foundry, where they were received by Mr. R. Ryder Terry, the Managing-Director of the Flavel Range and Imperial Gas-Stove Company, who offered further hospitality in the shape of light refreshments. Here some time was spent in inspecting the large installation of Millennium high-pressure gas-lights, and looking over the works; and afterwards most of the

members left for the station, delighted with what they had seen and heard, and with all that had been done for them. In fact, there was only one thing that could have been better, and that was the weather; but fortunately the rain ceased before the time arrived for the drive.

## SCOTTISH JUNIOR GAS ASSOCIATION.

### WESTERN DISTRICT.

#### Visit to the Provan Gas-Works.

The members of the Western District Section of the above-named Association brought their session to a close on Saturday last by a visit to the Provan Gas-Works of the Glasgow Corporation. This was an extra item on the syllabus. The members seemed to look upon the opening to them of these fine new works as a privilege of no ordinary sort; for they turned out to the number of nearly a hundred to participate in the pleasures offered. On assembling at the gate of the works, the visitors were made up into parties of twenty, to whom the following were appointed leaders: Mr. J. M'Leod, of Kirkintilloch (late of Provan); Mr. J. Webster, the Manager; Mr. C. M'Farlane, the Chemist (successor to Mr. M'Leod); Mr. J. Fraser, the General Foreman at Provan; and Mr. Byers, of Wall Street. The works having been inspected, tea was served in the workmen's mess-room—Mr. Alex. Wilson, the Engineer, in the chair.

The Chairman said it had been a pleasure to him, all through the winter, to see the way in which the affairs of the Association had been carried on. He thought the papers read and the interest taken in them augured well for the future of the Association, and also of the gas industry in Glasgow, which had benefited by having members from the outside districts coming into the meetings as much as the outsiders had benefited by coming into Glasgow. It was a mutual improvement society; and he thought it was for the benefit of the whole that they should have this intercommunication between the two classes. Once or twice it had been mooted that the Junior Association ought to be joined on to some of the older ones. He hoped this would not take place just yet. He would like the Junior Association, at least for a little while, to run on its own legs. Later on, it might be to the benefit of the younger, as well as of the older Association, if the two were joined in some way—the one affiliated with the other. He thought the Junior Associations had taken the right lines in going about their business, because they had not only papers read every month, and very well discussed, but also had visits to various works; and the visit that day was a fair example of what might be done in this respect. Speaking for himself, he thoroughly enjoyed visits to works. It did not matter very much what they were—tube, brick, oil, or engineering works—men could always learn something if they kept their eyes and their ears open as they were going round. He thought the older Association might be well advised if they tried to do a little more in this line, and took a leaf out of the book of the younger ones. He considered their meeting that day was going to form a worthy conclusion to the winter's work. He was pleased to see so many of the members of the North British Association with them. A good deal of the success of the Junior Association had, he thought, been due to the officials they had appointed. Their worthy Secretary—Mr. G. Braidwood—was not with them that day; but they would thank him for the trouble he had taken in connection with the gathering. However, they had with them their President, Mr. J. M'Leod. It was very encouraging to the members of the Junior Association that both he and their Vice-President had been promoted to two of the most recent important positions that had been vacant in Scotland. He thought all young men ought to look well ahead and try to get to the top of their Associations, as people outside took stock of what they were doing. He thought the Corporations of Falkirk and Kirkintilloch were to be congratulated on getting two such good servants as the President and the Vice-President of the Junior Association. They wished these gentlemen every success in their new spheres, and he had not the slightest doubt that they would be a credit to the positions they had taken up, and would shed lustre on the Western District Junior Association.

Mr. M'Leod said it was very encouraging to see such a large turn-out as they had at their extra meeting. When the idea occurred to him to hold it, Mr. Wilson gave him every encouragement. He could only endorse what the Chairman had said; and he had to thank them for turning out in such large numbers.

Mr. L. Hislop, having been called upon, as President of the North British Association, expressed the pleasure which the seniors had in being invited to be there that day. He envied the Junior Association the talent they were showing they possessed within their ranks. They were indebted to Mr. Wilson for the treat they had enjoyed in visiting gas-works which were second to none in Scotland.

Votes of thanks having been accorded, on the motion of Mr. J. W. Carmichael and Mr. J. Napier Myers respectively, to those who had entertained the members and to the Chairman and the Glasgow Corporation for their hospitality,

The Chairman expressed the pleasure with which he, with the cordial approval of the Gas Committee, had been able to receive the members; and he invited them to come to the works again and again if there was any part of them which they wished to see. They had made a very good finish to the work of the session, and he hoped they would start the new one in a somewhat similar fashion.

During the evening an excellent musical programme was gone through by members of the Association; and the proceedings were closed by a very spirited rendering of "Auld Lang Syne."

## SCOTTISH JUNIOR GAS ASSOCIATION.

### EASTERN DISTRICT.

#### Visit to the Broxburn Oil-Works.

The members of the Eastern District Section of the Association brought their session to a close, on the afternoon of Saturday, the 30th ult., by a visit to the works of the Broxburn Oil Company. The party, numbering twenty-five, were under the leadership of the Vice-President (Mr. D. Bisset, of Edinburgh) and the Hon. Secretary (Mr. John R. Moyes, of Edinburgh); the President (Mr. W. Brown, of Lasswade) having unfortunately been detained at home by indisposition. They travelled to Drumshoreland Station, where they were met by Mr. D. R. Steuart, the Chief Chemist to the Company, and immediately drove to the works.

In the office Mr. Steuart explained the processes carried on; and then he and his chief Assistant—Mr. G. M'Killop—conducted the visitors through the works. These are on a very extensive scale, putting through 1600 tons of shale per day. Three seams are now being worked, the uppermost of which—Broxburn—comes to the surface, and is mined from an incline which runs down within it, with side workings. Other two seams, a considerable way down—the Dunnet and the Drumshoreland—have not yet been touched. On being brought to the surface, the shale is broken, and then conveyed by mechanical means to the top of the retort-stacks, which are 70 feet in height, where it is emptied into iron hoppers, large enough to contain sufficient shale for a night's carbonization. The retorts are the patent of Mr. Norman M. Henderson, the Manager of the Company, and are constructed on the principle now universally in use; an important feature being that at the bottom of the working part of the retort the spent shale is removed from it by two revolving drums, and falls into a hopper, whence it is removed at stated times. The retorts are heated entirely by the gases evolved, after they have been washed for ammonia and other products. The machinery in the works is driven by steam; and the oil vapours, on their way to the condensers, are made to pass in pipes through a vessel containing the feed water for the boilers, by which means the gas is considerably cooled, and the water raised in temperature. The gases remaining after condensation and washing are driven back by fanners to the furnaces. After separation, by settling in tanks, the ammoniacal liquor is treated on the spot in plant of the continuous type. The crude oil is run by pipe to the refinery, about half-a-mile away. In the refinery, stills in series (the invention of Mr. Henderson) are employed for the recovery of the different grades of oils and the solid paraffin. These were all shown at work, with furnaces burning tar; and the visitors were afterwards conducted through the part of the works where the paraffin wax is refined, the candle factory, in which there is a very large production, and the works where the manufacture of sulphuric acid is carried on. The itinerary lasted about three hours; and during the time very much was seen that was exceedingly interesting. It was stated that the yield from different shales varied, but that from 20 to 30 gallons of oil and from 60 to 70 lbs. of sulphate of ammonia can be recovered from a ton of shale.

At the conclusion of the visit, Mr. Bisset proposed a vote of thanks to Mr. Steuart and Mr. M'Killop for the trouble they had taken in conveying the members through the works, in which he was sure they had all received an educative influence. It was interesting to them to see the vertical mode of retorting, on account of the experiments in this direction now going on in gas-works; and perhaps ten years hence it might be found that gas was being made in retorts of this kind. He asked Mr. Steuart to convey to the Company the thanks of the members for the kind permission which had enabled them to see their interesting works. Mr. Steuart expressed the pleasure they had had in seeing the Association, and said he hoped they might be able to return at a time when they would see the whole of the works in operation, which they could not do on a Saturday afternoon.

This brought the visit to a close, and the company dispersed.

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Among the arrangements of the Society of Arts for the present and next month is a paper on "The Production of Coke and its Application to Domestic Fires," to be read by Mr. Paul Schlicht at the ordinary meeting on the 8th prox.

Returns recently issued show that during 1905 the number of collieries using coal-cutting machines was 295, and the number in use was 946, of which 446 were electrical and 500 compressed air. The total bulk of coal produced by these machines was 8,102,197 tons. Out of the 3126 collieries in the United Kingdom, fewer than 10 per cent. use machines. Some owners look upon them as dangerous; cheap labour is another consideration; and machines of any or every sort are not regarded with favour by the operative miner. In all South Wales, only 14 machines are in operation.

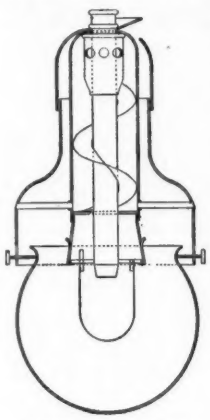
# REGISTER OF PATENTS.

## Inverted Burner with Preheated Air Supply.

PROSKAUER, M., and PROSKAUER & Co., of Berlin.

No. 5714; March 9, 1906.

The patentees claim that better utilization of the gases of combustion ascending from the mouth of the burner is obtained by providing, in the first place, the preheating chamber, which surrounds the mixing-tube for the greater part of its length (and the lower part of which is connected by tubes with the outside air), with means for extending the path of the air flowing to the air admission openings of the mixing-tube, and also by surrounding the chamber with an outer mantle or jacket, which is shut up in its upper part with the exception only of an opening provided in one side of the mantle. For this purpose (as shown), a metal spiral or several spiral wires are placed around the mixing-tube, or metal sieves may be placed in the heating chamber, or perforated metal plates with alternatingly arranged holes, or similar means may be provided in the chamber. Then the heating chamber itself may be provided with constricted parts, or may be spirally twisted, or it may be shaped, both at the interior as well as at the outside, as a ribbed heater of large surface. "The fact that the heating chamber for the air of combustion is shaped at the outside as a heating body of large surface presents the additional advantage that the gases of combustion which pass along the same are free to transmit their heat to a body of this kind in the most efficient manner."



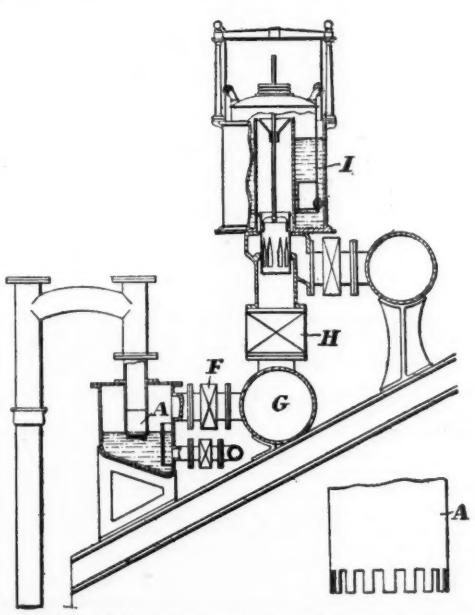
**Proskauer's Inverted Burner.**

## Hydraulic Mains.

CLOUDESLEY, J. L., jun., and COLMAN, H. G.

No. 7479; March 28, 1906.

It is claimed by the inventors that, by means of the arrangement they describe in their patent specification, "pressure in the retorts can be regulated with considerable accuracy according to the quantity of gas being at any time generated, and the loss due to uneven flow and porosity of the retorts is reduced to a minimum, and, further, the main difficulty in the way of employing shallow seals in the hydraulic main is removed." It is possible "to adjust and maintain the operative seal to give with a given coal an increased value to the factor obtained by multiplying the yield per ton by the illuminating or calorific value of the gas." The proposal is to serrate the lower ends of the pipes leading from the retorts to the hydraulic main, and arrange the pipes with their serrated edges under the liquid in the main; so that any sudden rush of gas is split up into small bubbles. A pressure governor or regulator is also interposed between the retorts and the exhauster, whereby "the gas passes through the hydraulic main without causing material disturbances of the liquid, and a very small seal may be maintained."




**Cloudesley and Colman's Improvements in Hydraulic Mains.**

As shown, serrated edges are formed on one end of a short piece of pipe A of rather less diameter than the dip-pipe. The serrations are preferably of the type shown, or they may be formed with rounded upper edges, "as these are less liable to collect tar and become choked than other types." The top edges of the serrations are not lower than the end of the dip pipe, which still controls the depth of seal; and it is preferred to "provide a tail piece on the removable sleeve A, by which it can be taken out readily for cleaning without stopping the working of the other retorts."

The gas is exhausted from the hydraulic main through a pipe F, foul main G, and pipe H, with which is connected a governor or pressure regulator. Such a governor is said to "be essential to the successful operation of the plant; the serrated edges sealed by the hydraulic main not being in themselves sufficient to obtain such a substantially steady pressure as is required—the serrations only having the maximum effect when the suction on the hydraulic main is approximately constant. In fact, it has heretofore been proposed to use serrated edges alone to pipes dipping into the hydraulic main, in order to keep the tar and liquor in a state of continued agitation."

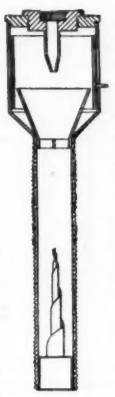
## Inverted Incandescent Gas-Burners.

SIEGENBERG, L., of Highbury New Park, N.

No. 10,615; May 5, 1906.

This inverted incandescent gas-burner has a coil in the mixing-tube to prevent the gas lighting back at the nipple. The coil is formed by winding a suitably shaped blank of sheet metal, as distinguished from wire coils which have already been proposed.

The coil is inserted in the burner-tube with its point preferably directed towards the gas-nipple I. The air and gas impinge on the point, and, then following the winding of the coil, issue from the end of the burner-tube through the spaces in the bottom of the coil. With such a coil the patentee says he is able to "considerably increase the length of the flame of an inverted incandescent gas-burner, and also effectually prevent back-lighting at the nipple." In combination with the coil, there may, in certain cases, be provided at the upper end of the burner-tube a funnel extending into the mixing-chamber and having its mouth of less diameter than the wall of the mixing-chamber, in order that the funnel may be kept cool by air circulating around it.



**Siegenberg's Inverted Burner.**

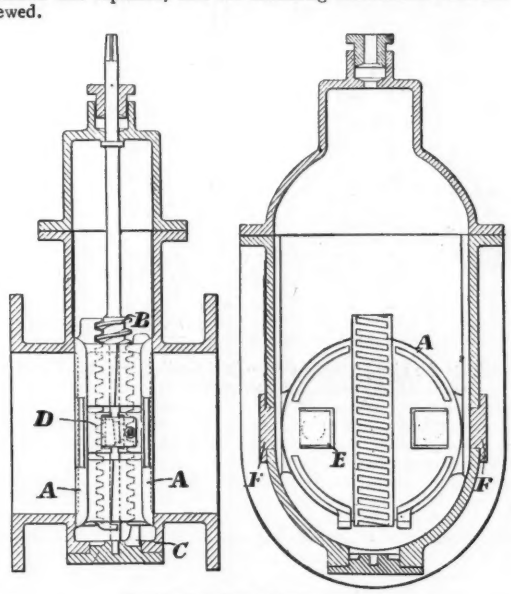
## Valves.

DONKIN, H. J., and HAIGH, T. H., of Chesterfield.

No. 12,734; May 31, 1906.

In this construction of double-faced sliding-valves for gas, water, &c., the faces of the valve are relieved from pressure against their seats before the valve is moved into its open position, and liability of the valve becoming set-fast in its closed position is thus minimized.

The valve comprises two faces or "doors" so arranged that, in closing, they advance simultaneously until the valve is nearly closed, when one door receives a motion relative to the other in the direction of their travel, which motion causes the doors to be wedged apart or otherwise forced on to their seats, which (as usual) are arranged in parallel planes. The arrangement is such that, in opening the valve, one door is first moved slightly, thereby relieving the wedging or other action forcing the two doors apart; the second door only moving when the doors are thus relieved. When both doors are shut, the space between them is entirely cut off from the gas or water on both sides of the valve; so that the valve casing may be opened to the atmosphere to enable the interior to be cleaned, the springs (provided to force the doors apart on to their seats as they are opened and closed) to be examined and replaced, and the actuating mechanism removed and renewed.




**Donkin and Haigh's Slide-Valves.**

In the form of valve shown, two doors A are faced to make tight joints with the opposite valve seats, and arranged back to back. Each is provided with a vertical rack; the two being adapted to be engaged by one worm B that lies between them, and also provided with wedge surfaces formed on lugs arranged in a circular row near the margin of each door and adapted to allow the distance between the doors to vary as the relative positions of the doors in a transverse sense varies. One of the racks is shorter than the other, so that, in closing the valve,

both doors are moved together until the one with the shorter rack becomes disengaged from the worm and at the same time rests upon a stop C on the valve casing. Further rotation of the worm then causes a continued movement of the door with the long rack; and the relative transverse movement of the two doors (owing to the wedge surfaces) causes them to be pressed apart against their seats. In opening, the door with the long rack is lifted alone until the pressure of the wedge surfaces forcing the doors to their seats has been relieved, after which projections on the back of this door engage beneath projections on the back of the door with the short rack (in this case the wedge surface lugs), and lift it so that its rack becomes engaged again with the worm B.

The doors A are forced apart on to their seats (while being opened and closed) by volute springs D, one end of each of which bears directly against a co-acting boss E on the back of one door, while the other end bears indirectly against a similar boss on the adjacent door —for instance, against the wing of a plate seated upon the boss. This plate forms the fourth wall of a box, of which the other three sides are formed integral with the boss and loosely and removably secured to it, opposite to that upon which its wing is seated—as by a stud passing through a slot in the plate, whereby, on removing the cover plates F of the inspection openings in the valve casing, the springs can be examined and renewed if required.

## Gas-Mixing Apparatus.

WOUWERMANS, P. VON, and LOEWENSTEIN, L., of Vienna.

No. 7814; March 31, 1906.

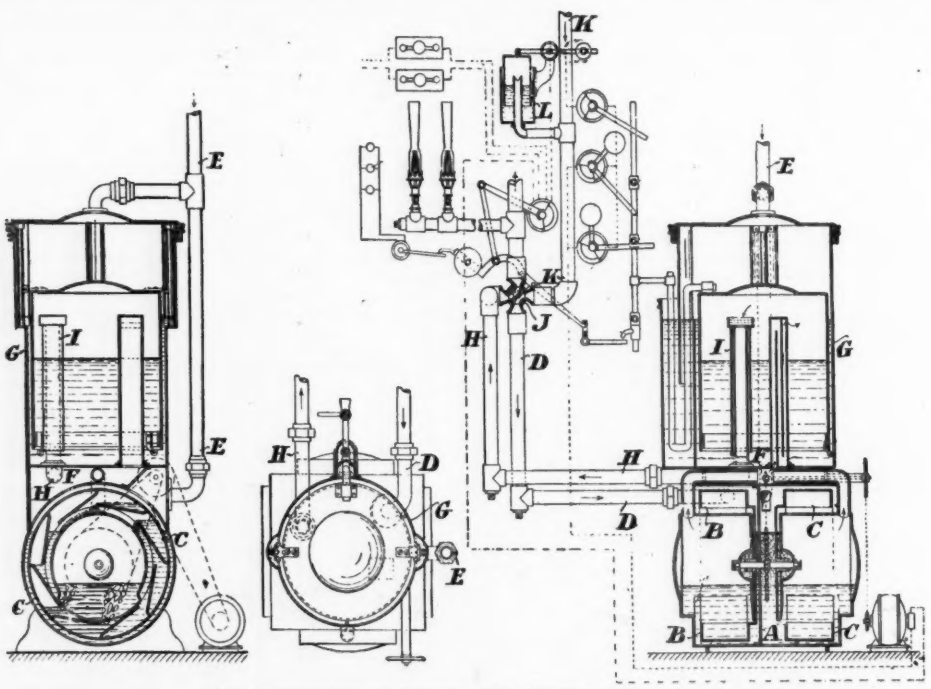
The invention relates to "apparatus in which gas and air are mixed in definite proportions and led from a common mixing-chamber to the supply mains of an incandescent gas-lighting system." It consists in combining a rotary hydraulic compressor with the mixing-chamber and gas-collector—the whole (hermetically sealed) being so arranged that the mixing of the air and gas is first effected in the gas-mixing chamber, while special safety devices are provided for avoiding any explosion occurring in the apparatus.

The illustrations show two vertical sectional elevations of the hydraulic drum compressor at right angles to each other, and a horizontal section.

The hydraulic compressor consists of a closed casing with an intermediate wall, through which a driving shaft passes, and two compressor drums, communicating through openings with chamber, divided by the partition A. The shaft is driven by an electric motor, and carries the cell drums B C, closed towards the outside and open towards the inside. The working of the motor can be regulated by a bell or the like in the usual way, according to the consumption of gaseous mixture by the burners. The left-hand chamber is connected to the gas-supply pipe D, and the other chamber to the safety air-pipe E. Gas and air compressed in the drums is led into the mixing-chamber F; and from here it passes through a pipe (provided with a small opening for the escape of any water of condensation) into the gas-collector G, in which a bell slides up and down—guided by rollers on guide-rods arranged in channels or flutings on the upper part of the container wall. The bell has a U-shaped controlling rod, which moves in a water seal formed by lower and upper flutings on the container wall. The upper edge of the container is provided with a trough filled with oil; thus forming an air-tight seal for the lid of the collector G. A branch pipe leads from the lid to the safety air-pipe of the compressor.

The gaseous mixture passes from the bell to a pipe connected to the pipe H, by which it is led away. A dip-pipe I passes over this pipe and has a safety gauze arranged on its broadened head, which can thus be easily changed and inserted in a gas-tight manner by means of a liquid seal.

The gas passes from the supply pipe D into the left-hand chamber of the casing; and on the motor being started, the gas is drawn up by the drum B, compressed, and then conducted into the mixing-chamber F. Air from the atmosphere separately passes through the safety air-pipe E into the right-hand chamber of the casing, and is drawn up by the cell drum C into the compressor drum, compressed, and then conducted into the mixing-chamber F. Thus in the compressor itself no mixing of any dangerous composition can take place. Further, if for any reason an excessive pressure occurs in the drums, and presses the water level in them below the openings, the compressed gas always passes back into the gas-chamber and the compressed air into the air-chamber. The mixture of the previously (and independently) compressed air and gas first takes place in the mixing-chamber F, and then the air and gas mixture passes under the gas-collecting bell, and thence through the safety gauze into the mixture main H without there being any danger of an explosion, "owing to the air-tight sealing of the whole arrangement at all dangerous points." The air necessary for working the arrangement is taken from the outer atmosphere through the safety pipe E, which




Von Wouwermans and Loewenstein's Gas-Mixing Apparatus.

also conducts the air ejected or drawn in the collector G by the up-and-down movement of the bell. In the event of excessive evaporation of the water and escape of gas, either from the compressor or the bell, the gases are caused to escape through the safety pipe E. The controlling rod of the gas-collector bell is fitted with three stops for electric switches, and with a fourth stop for controlling the cock J.

In order that the compressor motor may be switched off when interruptions occur in the gas-supply pipe K before the gas reaches the mixing apparatus—whether they arise from a main cock in the pipe being closed, the gas-meter chamber jamming in the gas-meter, leakages occurring, or the like—and consequently resulting in air being passed into the gas-pipe and into the gas-chamber of the compressor, or in relatively too little gas being supplied (whereby, in spite of the separate compression of definite proportions of air and gas in the compressor, the explosion limit of the gas and air mixture may be surpassed), an oil receptacle L, with regulating bell, is arranged in the gas-supply pipe, which, as soon as the pressure sinks below a certain amount, operates a switch, and consequently cuts off the motor current. Thus the bell sinks completely down, and the gas-mixing apparatus is cut off by the turning of the four-way cock. A counterweight can be adjusted on the bell lever, so as to adjust it exactly as required to the lowest pressure at which the cutting off has to be effected.

## Inverted Incandescence Gas-Lamps.

DEUTSCHE GASGLÜHLICHT AKTIENGESELLSCHAFT (AUERGESELLSCHAFT), of Berlin.

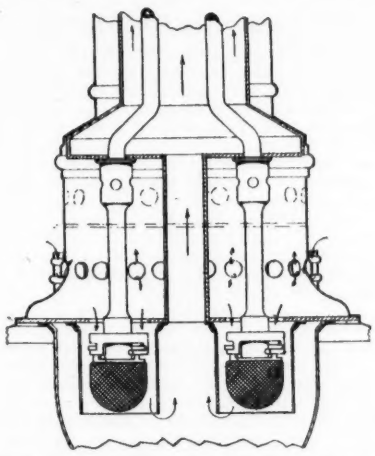
No. 26,765; Nov. 24, 1906. Date claimed under International Convention, Nov. 28, 1905.

This invention relates to inverted incandescent gas-lamps of the type in which the air to support combustion is led to the flame in a direction parallel to the flow of gas and air mixture. In such lamps the secondary air current and the gases of combustion are drawn down by the action of a chimney into a cylindrical casing surrounding the flame.

The object of the invention is to apply this principle, in the manner shown, to inverted-burner lamps in which two or more incandescent bodies are arranged below an air-chamber surrounding the mixing-tubes of the burners and around a centrally arranged chimney, in such a way that the combustion gases are drawn off through the centre of the lamp or group of burners. At the same time the incandescent bodies may each be surrounded by a separate chimney suitably prolonged downwards into the globe space of the lamp to below the suspension device for the mantles.

This arrangement is said to afford important advantages in several respects. As the heating gases are led off centrally, the lower part of

the lamp—particularly the globe and the wall of the air-chamber surrounding the air and gas mixing devices—becomes heated "to the smallest extent," so that the possibility of the globe breaking by the action of the hot gases is lessened. Furthermore, the air can be so supplied from the air-chamber to the incandescent bodies as to cool the



A German Incandescent Double-Burner Lamp.

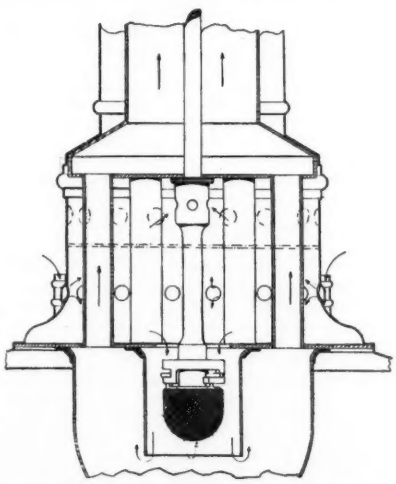
suspension devices for the incandescent bodies in its passage. It is also important that the base of the air-chamber should be kept cool in order to avoid transference of heat to the edge of the base; the transference of heat to the globe being thereby lessened. Furthermore, the mixing-tubes and burner-heads are readily accessible from the outside for erection and attention.

## Inverted Burner Incandescent Gas-Lamps.

DEUTSCHE GASGLÜHLICHT AKTIENGESELLSCHAFT (AUERGESELLSCHAFT), of Berlin.

No. 26,766; Nov. 24, 1906. Date claimed under International Convention, Nov. 28, 1905.

According to this invention, the up-take passages of the lamp are not (as, for example, in Patent No. 23,619 of 1899) intended to concentrically directly surround the gas and air mixing-tube; but the gases of combustion are led away by up-take passages grouped round the mixing-tube and the cylinder which surrounds the flame—such passages extending through an air-chamber containing the mixing-tubes. At the same time the supply of external air to the burner flame takes place through the centre of the air-chamber, the base of which carries the cylinder.



A German Incandescent Single-Burner Lamp.

In regenerative lamps heretofore proposed, the patentees remark, the gases of combustion have been led away in a similar manner by separate tubes grouped round the burner-tubes, and which are led into the up-take chimney through the preheating chamber for the air supplied to the burner. Moreover, incandescent lamps with inverted burners, in which the preheating of the external air to support combustion is effected by means of an air-chamber situated above the incandescent bodies, and from which the air is supplied to the incandescent bodies in the manner described, have also been proposed. The present application, therefore, is not intended to include such arrangements, but rather in the application of the up-take pipes in the air-chamber of lamps having inverted burners.

This construction is said to offer important advantages in many respects. Above all, the external air is efficiently preheated by the up-take pipes passing through the air-chamber, so that the air is supplied in a preheated state both to the mixing device as well as to the flame. Furthermore, in order that the mixing-tube and the burner-jet shall be easily accessible, the cylinder and the globe can be removed in a simple and convenient manner. In addition to this, there is the advantage that the air supplied to the flame to support combustion cools the head of the burner carrying the incandescent body, so that it, on the one hand, can not be too strongly heated, while, on the other hand, the heat radiated from it still further preheats the air supplied.

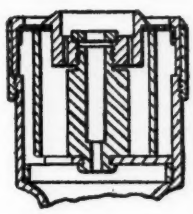
Finally, the lamp, as shown, is "well adapted for lighting in the open air, as, owing to the subdivision of the gas up-take into a comparatively large number of single passages surrounding the flame, gusts of air are broken up and their force lessened before reaching the flame.

## Incandescent Gas-Burners.

ABEL, K., of Vienna.

No. 21,759; Oct. 2, 1906.

This invention has for its object to provide a conically tapering outwardly flanged insertion piece in an incandescent burner—screwed in such a way on the upper end of the burner-tube of the ordinary burner-head that the mouth of the insertion piece only slightly projects above the upper edge of the burner-cap. Several air-passages are also arranged round the (fire-clay) ring in the insertion piece. In consequence of the small surface in comparison with the ordinary arrangements which the insertion piece presents to the flame playing round it, "the latter is hardly cooled at all, so that the formation of soot is reduced to a minimum." The air flowing upwards through the gauze reaches—in consequence of the inclined edge of the insertion, and also on account of the small height of the latter—without appreciable diversion the gas escaping from the aperture of the insertion, "whereby simultaneously an advantageous combustion is produced." In fact, it is "possible to produce a far more intense flame than under similar circumstances in the ordinary burner-heads."



Abel's Incandescent Burner.

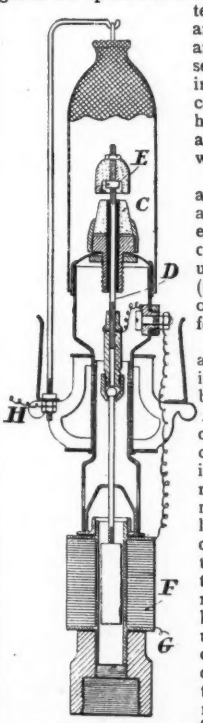
## Electrically Lighting-Up Gas-Lamps.

ELECTRICAL IMPROVEMENTS LIMITED, and HACKING, A. E., of Nottingham.

No. 12,024; May 23, 1906.

This invention relates to electrically ignited gas-lamps, whereby the gas is lit up at the burner by an electric arc formed by separating terminals (preferably carbon) normally together, and sustained, in the same way as the arc of an arc lamp is sustained, so long as the means for separation are in operation—thereby "providing means so that the ignition of the gas is certain." The separation is primarily through hand-operated means, preferably bringing into action a solenoid the core of which, by its weight, normally brings the terminals together.

When applied to an incandescent gas-burner, a small central rod passes down the fixed burner and through the crown of it, and at its upper end supports a carbon block, which is therefore central of the burner, and which normally rests upon a conducting ferrule, bush, or the like (preferably of carbon) forming the central part of the burner crown. Both terminals are therefore within the mantle.




Hacking's Electric Gas-Lighter.

The illustration shows a burner body of suitable construction for the application of the invention. Centrally upon the crown of the burner is a fixed arcing terminal C electrically connected to the burner body. An electrical conductor, in the form of a thin rod D, works centrally through the fixed terminal (from which it is insulated by bushing) to support and carry rigidly at its upper end (above the fixed terminal) a movable arcing terminal E. The lower end of the rod is connected to the core of a solenoid F, by the operation of which the rod is moved up and down to control the arcing—the movable terminal normally resting upon the top of the fixed terminal by the weight of the solenoid's core. The underside of the movable arcing terminal is concaved to accommodate a conducting collar of the rod D (the collar must be kept clear of the fixed terminal C at all times) and to make more effective the arcing; the terminal being fixed to the rod between the collar referred to and a further collar or screw-nut on the top of the terminal.

The current passes to the solenoid by the wire G, and from the solenoid to the central rod D, and thence to the moving arcing terminal, which is moved by the solenoid to form an ignition arc (which can be sustained until the gas lights) between the two terminals—the return passing from the fixed terminal through the burner body to the wire H. The operation of one switch separates the terminals and closes the arcing circuit; but the terminals may be separated by an operation other than electrical—for instance, by a separate hand lever, the gas being turned on either by hand through mechanical arrangements or electrically.

A number of burners can be lit up simultaneously—the burners being either arranged in series or parallel with each other; but particularly the invention admits of burners being connected up in series and lit up simultaneously. In connection with incandescent gas-burners for

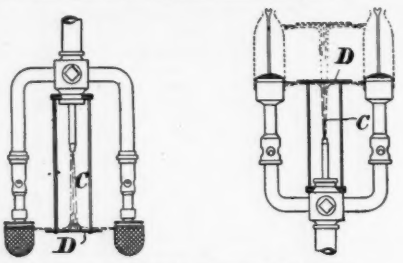
electric gas lighting, it has hitherto been proposed to use sparking terminals normally together and within the mantle, one of which is lifted for separation by an electro-magnet through a rod central of the burner, which rod at its upper end carries the movable sparking terminal—the electro-magnet also providing means for simultaneously turning on the gas; but by this invention the use of the weight of the core of the solenoid, or equivalent means, for normally bringing the arcing terminals together, "positively ensures the normal positions of the terminals being attained, the core being at all times, from the carbons, freely depending through the centre of the burner."

### Gas-Lamps with Two or More Main Burners.

HOWORTH, F. W.; a communication from the DEUTSCHE GASGLÜHLICHT ACTIENGESELLSCHAFT (AUERGESELLSCHAFT), of Berlin.

No. 1863; Jan. 24, 1907.

This invention relates to a construction of multiple-flame gas-lamps which necessitates the employment of only one igniting flame for all the burners; the "flame being only transitorily effective at the moment of lighting the lamp, for which purpose it is caused at that time to assume such a form that it ignites the several main burners."




**A German Multiple-Burner Flash Light.**

In both constructions shown the gas passes to the various burners, between which is placed the lighting flame C, with a baffle-plate D below or above it.

When the lighting is to take place, the full pressure of the gas is allowed to reach the lighting flame by suitably operating the cock. The lighting flame is considerably lengthened, strikes upon the baffle D, and is flattened out by it for such a distance that gas at the main burners situated around it are lighted by the flame spreading beyond the edge of the plate. The plug of the cock is then further rotated in the usual way, so that the supply of gas to the permanent lighting flame is throttled.

The baffle-plate D is placed either in the plane of the exit of gas from the main burners, or, in the case of upwardly burning lamps, level with the glass chimney, as shown by the dotted lines.

### APPLICATIONS FOR LETTERS PATENT.

7076.—BELLAMY, H. M. & A. R., "Producing gas for use in engines and other purposes." March 25.

7082.—DUNN, L., and JENKINS, A. E., "Generation and consumption of true water gas in furnaces." March 25.

7086.—STEFFENS, F., "Gas-turbine." March 25.

7102.—EWART, J. W., "Gas-heaters." March 25.

7116.—BRANDENBURG, F., "Purifying gases." March 25.

7159.—GRIMSDELL, E. W., "Incandescent burners." March 25.

7176.—AUBLANT, J. J., "Controlling the ignition of gas-burners." March 25.

7191.—BARWELL, H., "Gas-fire cocks." March 26.

7197.—TOURTEL, J. M, and MEALING, W. R, "Automatically lighting and extinguishing gas-lights by varying the pressure in the mains." March 26.

7204.—WILSON, O. B. J., "Automatic lighting and extinguishing of gas-jets by changing the pressure." March 26.

7307.—TERRY, G., "Inverted globe holders." March 27.

7332.—COPP, H. E., "Gas-burners." March 27.

7362-3-4.—HUMPHREY, A. H., "Gas-lamps." March 27.

7367.—BROADBERRY, A. E., "Gas-lighting apparatus." March 27.

7381.—CLARK, F., "Hydraulic main." March 27.

7405.—KUNZLER, A, and SCHNEIDER, F., "Suction plant." March 27.

7436.—MOFFATT, J. A. S., "Heating steam-boilers by means of the exhaust gases from gas or oil engines." March 28.

7454.—HUGHES, T. V., "Gas-producers." March 28.

7469-70.—KEMP, C. W., "Atmospheric burners." March 28.

7506-7.—THOMPSON, C. H., "Gas-furnaces." March 28.

7532.—PARKER, T., "Destructive distillation of coal, and the treatment of carbonaceous and other substances." March 28.

7534.—GLOVER, S., and WEST, J., "Charging vertical retorts." March 28.

7540.—SECKEL, G. J., "Mantles." March 28.

7575.—DARWIN, H., "Gas-radiators." March 30.

7583.—THE RICHMOND GAS STOVE AND METER COMPANY, LTD., and SHERBURN, W. H., "Gas-burners." March 30.

7594.—HOOTON, R., "Manufacture of gas." March 30.

7605.—CHALLENS, F. E., "Combination gas and coal fire grate." March 30.

**The Expenses of Officials Attending Conferences.**—The District Auditor, Mr. F. M. Adams, has just disallowed a large number of payments made by the Wallasey Urban District Council for expenses incurred by members and officials in attending conferences in different parts of the country. Among the gentlemen with whose expenses the members of the Council have thus been surcharged, we notice Mr. J. H. Crowther, the Gas Engineer, £8 8s., and Mr. J. Kiernan, the Chairman of the Gas Committee, £8 13s., for attending the meeting of the Institution of Gas Engineers in London.

# CORRESPONDENCE.

[*We are not responsible for the opinions expressed by our Correspondents.*]

### Gas Products for Motor Driving.

SIR,—Your article on the above subject in last week's issue is of special interest to all engaged in tar distillation; and it probably may be of interest to some of your readers to learn that I have used mixtures of petrol and crude benzol, and on many occasions benzol alone, for the last four years, in a four-cylinder 20 H.P. car, with perfectly satisfactory results. Toluol and thirty per cent. crude naphtha have also been used; and but for the slight extra trouble caused in starting when "cold," the engine has apparently worked quite as satisfactorily as with "A" quality petrol.

Like many others, I feared that difficulties would arise from sooty valves or from faulty firing, caused by the deposition of unconsumed carbon; but no trouble was experienced in actual practice, although a "petrol" carburettor was in use which could not very readily be adjusted to suit the benzol.

I have also a 2¾ H.P. air-cooled De Dion motor on my motor bicycle, which has been in daily use for four or five years; and this has been driven on crude benzol alone for the last three years, with excellent results. The piston was examined recently, and found to be quite free from soot; in fact, no trouble whatever has been experienced from this source. I personally prefer benzol to petrol for the machine. The carburettor in this case is an old 2¾ H.P. De Dion, with "spirit" and "air" adjustment.

Now that the use of petrol is so rapidly extending, there is no doubt that a large market for surplus benzol awaits enterprising tar distillers; and even if motorists cannot be persuaded to use benzol alone, 30 to 60 per cent. of benzol could be added to petrol without any detriment to the working of the engine. But, on the other hand, from actual experience, it will be found that it will increase the distance travelled per gallon by from 10 to 15 per cent.

*Nottingham, April* 6, 1907. J. H. BROWN.

**The Proposed Amendment of the Sales of Gas Acts.**—The concluding paragraph of Mr. Church's letter on this subject in the last number of the "JOURNAL" (p. 35) did not, as printed, quite convey the writer's meaning. The point he wished to make was that where the Sale of Gas Act really wants amending is the clause which states that "all meters shall be tested at 5-10ths pressure." This Mr. Church thinks should be made to read: "All meters shall be tested at the average main pressure," which is rarely under 1 inch.

# LEGAL INTELLIGENCE.

### Thefts from Gas-Meters at Neath.

At the Neath Borough Police Court, last Friday, several lads, whose ages ranged from ten to nineteen, were charged with stealing various sums of money from gas-meters. They pleaded "Guilty," with the exception of the youngest, on whose behalf a strong appeal was made on the plea that he had been led away by older boys and did not know the nature of the offence. Two of the accused had been before the Court on a previous occasion, and were let off with a caution. This time they were each fined 5s. and costs, and would have eight strokes with the birch; two others were fined similar amounts and costs, with six and four strokes respectively; another was fined 10s. and costs, or seven days, in each case against him; and the youngest boy was sentenced to pay 5s. and costs.

### Embezzlement by a Gas Company's Collector.

At the Swansea Quarter Sessions, last Friday, Frank Southwood formerly a collector in the service of the Swansea Gas Company, was charged with fraudulently and feloniously embezzling 15s. 9d. on the 19th of October, 10s. 7d. on the 31st of December, and 18s. 9d. on the 15th of January last from the meters of the Company. Mr. L. M. Richards prosecuted; and Mr. L. Thomas defended the accused, who pleaded "Guilty." Mr. Richards said the defalcations extended over twelve or fifteen months, and, from a list submitted by prisoner himself, altogether amounted to £64 14s. 2d. The Company viewed the case with much anxiety. Two witnesses having given Southwood a good character, Mr. Thomas said he should like to submit some facts in mitigation of the offence. First of all, prisoner had made a clean confession of it, and gave the Company assistance in their inquiries. He was formerly a man of excellent character; but there were circumstances connected with the case where men not possessed of strong minds yielded. His work was arduous, no doubt, in carrying about a lot of copper during the daytime, and his wages were low. Mr. Richards objected to the last statement. He said there were always plenty of applications for the position of collector, and the Company looked upon the engagement of honest men for their work. The amount of wages paid had nothing to do with the case. The Recorder remarked that the question of wages could not be imported into the case, and that the Company paid for honesty, not for defrauding. After some remarks by Counsel on both sides, the Recorder said the case was a very serious one, as the prisoner had pleaded "Guilty" to the charge, and had, on his own statement, given the total amount of his defalcations at £64 14s. 2d. However, he would give him a chance, and sentence him to a period of imprisonment as a first-class misdemeanant, which meant that he would not be associated with gaol-birds. He would be sent to prison for three months; and the Recorder expressed the hope that the character of the prisoner would not deteriorate as a result of so light a sentence.

# MISCELLANEOUS NEWS.

## PRODUCTION OF GAS AND RESIDUALS IN AMERICA.

During the past few years, the annual volume on the "Mineral Resources of the United States," issued by the Geological Survey at Washington, has contained a chapter devoted to the production of gas, coke, tar, and ammonia. It has been a kind of supplement to the reports on the production of coal and the manufacture of coke; and it has been compiled by Mr. E. W. Parker, a member of the Geological Survey, in response to a demand from producers for statistical information. Previous to 1902 (in 1898), a special chapter on the subject of residuals was prepared for the report; and the annual reviews have since followed in a general way the same lines. The latest report includes, in addition to the statistics of the production of gas, coke, tar, and ammonia in gas-works and in bye-product coke-ovens, a statement of the production in 1905 of gas and tar at water-gas works using crude oil for enriching purposes. These statistics have not been considered in any of the preceding reports. In some of the gas-works, oil is used with the coal in the production of gas; but the entire production is included in the statistics of coal gas.

In 1902, there were 533 companies reporting—an increase of 100 compared with 1898. The reports included the returns from 1662 bye-products coke-ovens. In 1903, 528 coal-gas companies reported; the production including the output of 1956 bye-products ovens. In 1904, reports were received from 534 companies, and included the production from 2910 bye-products ovens. The correct report, made up from those received from 529 companies, includes the output of 2998 bye-products works. The comparatively stationary condition of the statistics, so far as the number of companies reporting during the last four years is concerned, is probably due to the fact that most of the development in gas-making in late years (outside bye-products coke-oven construction) has been in the manufacture of water gas. There were in operation in the United States in 1905 477 water-gas companies who reported their production to the Geological Survey. They produced a total of 82,959 million cubic feet of gas; while the entire production from coal-gas works and bye-products ovens was 43,655 million cubic feet. This shows that nearly two-thirds of the total quantity of gas produced was water gas. About 8 per cent. of the coal gas and nearly 7 per cent. of the water gas made was lost by leakage, fire, or otherwise; the total quantity of coal gas saved and sold being 40,454 million cubic feet, and of water gas 77,412 millions. Of the coal gas sold, 26,818 million cubic feet were for illuminating, and 13,636 million cubic feet for fuel purposes. Of the water gas sold, 59,532 million cubic feet were for illuminating and 17,880 million cubic feet for fuel. The total gas sold for illuminating purposes was, therefore, 86,350 million cubic feet, and for fuel 31,516 million cubic feet; indicating that 73 per cent., or nearly three-fourths of the total consumption, was for light, and 27 per cent. for heat.

The total quantity and value of gas, coke, ammoniacal liquor, and sulphate of ammonia in 1905 were as follows:—

| | Quantity. | | Value. |
|---|---|---|---|
| Gas sold . . . . . cubic feet | 40,454,215,132 | .. | $32,937,456 |
| Coke . . . . . short tons | 5,751,378 | .. | 18,844,866 |
| Tar . . . . . gallons | 80,022,043 | .. | 2,176,944 |
| Ammonia (reduced to $NH_3$) lbs. | 22,455,857 | .. | 1,728,254 |
| Sulphate of ammonia . . ,, | 38,663,682 | .. | 997,452 |

*Coal Gas.*—The quantity of gas produced at gas and coke works in 1905, as reported by the 529 companies who made returns to the Geological Survey, was 43,654,807,037 cubic feet. Of this amount, 3,200,591,905 cubic feet were lost through leakage, fire, or otherwise, and reported as "unaccounted for." The net product sold, therefore, amounted to 40,454,215,132 cubic feet, which was valued at $32,937,456, or an average of 81·4 c. per 1000 cubic feet. In 1904, the total quantity of gas sold was 34,814,991,273 cubic feet, valued at $32,090,998—an average of 92 c. per 1000 cubic feet; while in 1903 it was 31,049,461,511 cubic feet, valued at $30,315,776, or an average of 97 c. per 1000 cubic feet. These figures indicate a decided decline in the selling price of gas; and it is interesting to note that the average price of bituminous coal at the mines during the same period declined from $1·24 per short ton in 1903 to $1·10 in 1904 and $1·06 in 1905. The decline in gas values may, however, be attributed largely to the increased use of fuel gas, which is particularly noticeable in the statistics for 1905. In 1903, the quantity of gas sold for fuel purposes was about 8100 million cubic feet, at an average of 98 c. per 1000 feet; in 1904, the sales of fuel gas were a little less than 9000 millions, at an average price of 96 c.; while in 1905 the consumption amounted to upwards of 13,600 millions, with an average value of 72 c. per 1000 feet. At the same time, there has been a decline in the average price of illuminating gas from 97 c. in 1903 to 91 c. in 1904 and 86 c. in 1905.

Compared with 1904, the total production of gas in 1905 (excluding that lost or unaccounted for) shows an increase of 5,639,223,859 cubic feet, or 16 per cent. The total value increased $846,458, or 2·6 per cent. Of the total increase in production, 4,685,485,021 cubic feet, or more than 83 per cent., was in the quantity of gas sold for fuel purposes. In 1905, the quantity of gas sold for illuminating purposes was 26,817,836,022 cubic feet, against 25,864,097,184 cubic feet in 1904. The fuel-gas sales were 13,636,379,110 cubic feet in 1905, against 8,950,894,089 cubic feet in 1904. In addition to the gas produced at coal-gas and bye-products works in 1905, there entered into consumption 77,412,024,591 cubic feet of water gas, of which approximately 59,530 millions were sold for illuminating, and 17,880 millions for fuel purposes. From this it appears that more than twice as much water gas as coal gas is used for light, and that nearly two-thirds of all the gas consumed is water gas.

New York remains in the first place as a producer and consumer of gas; the quantity of coal gas made and sold in that State in 1905 amounting to a little more than 5000 million cubic feet—a decrease of 260 millions from 1904. In the production of water gas, New York far outranks all other States, with more than one-third of the total. Massachusetts supplanted Ohio in 1905 in the total quantity of gas consumed; though the latter State exceeded the former in gross production. The quantity of gas unaccounted for in Ohio, however, was more than double that in Massachusetts, which gave the latter State a slight advantage, with a total net production of 4975 million cubic feet, compared with 4729 millions for Ohio. Massachusetts is also an important producer of water gas; while Ohio's production is comparatively insignificant. Pennsylvania is fourth in the manufacture of coal gas, with a net production in 1905 amounting to 3911 million cubic feet. This State is also an important producer of water gas, being third in rank (Illinois standing second), with a net production in 1905 of 8500 million cubic feet. Michigan ranks fifth in the production of coal gas, with sales amounting to 3264 millions in 1905. Alabama, by reason of the development of bye-product coke making in the State, shows a remarkable increase in the quantity of gas sold for fuel purposes, and leads all other States in this regard, with Pennsylvania second, Ohio third, and Michigan fourth.

In the quantity of coal carbonized, Pennsylvania stands first, Massachusetts second, Ohio third, New York fourth, and Michigan fifth; the first two leading in this respect because of the large quantity of coal used in the coke-ovens—the greater part of the gas produced therein being consumed in the process of coking. Of the total production of 43,654,807,037 cubic feet of coal gas made in 1905, 3,200,591,905 cubic feet, or 7·3 per cent., were lost by leakage, fire, or otherwise, compared with a loss of 2,856,848,400 cubic feet, or 7·6 per cent., out of a total production of 37,671,839,673 cubic feet, in 1904. The largest relative losses in 1905 were shown in the production of West Virginia, in the combined production of Idaho, North and South Dakota, Utah, and Wyoming, and in North Carolina. The smallest losses were made in California, Georgia, Maryland, District of Columbia, Alabama, and Arkansas. There were 11 States and territories reporting losses less than 5 per cent., and 25 where the losses exceeded 10 per cent.

In the three years preceding 1905, about three-fourths of all the coal gas produced and sold was used for illuminating purposes; 74 per cent. being so consumed in 1904, 75 per cent. in 1903, and 80·45 per cent. in 1902. The returns for 1905, however, show that only 66 per cent. of the total was used for lighting purposes, and that 34 per cent. was employed for heating. The increase in the consumption of fuel gas from 19·55 per cent. in 1902 to 34 per cent. in 1905 is significant, and illustrates forcibly the growing popularity of gas for cooking and other household purposes. Many of the gas-making companies are offering inducements in the way of lower prices for gas when used for heating—even when drawn from the same mains as the lighting gas—separate meters being installed. Another reason for the increased percentage of fuel gas is the fact that probably the larger part of the gas output of bye-products coke-ovens is used for iron and steel making—the ovens being operated in connection with the iron and steel mills. The actual quantity of coal gas used for fuel purposes has increased nearly 150 per cent. in three years—*i.e.*, from 5678 millions in 1902 to 13,636 millions in 1905.

*Oil and Water Gas.*—Since the manufacture of coke in retort-ovens assumed, in 1897, an importance sufficient to be considered an independent industry, the problems regarding the supply of, and the demand for, the bye-products obtained have created a desire for statistical data as to these products as produced at gas-works; and as no other bureau of the Federal Government was charged with the duty at that time, the Geological Survey undertook the preparation of the special report on the production of gas, coke, tar, and ammonia. Similarly, the statistics relating to coal gas suggested a desire for information as to the production of oil and water gas; and, in response to numerous requests, the following information has been collected and compiled.

Returns were received from 477 companies producing oil and water gas; and they show that the total production of water gas in 1905 was 82,959,228,504 cubic feet. Of this quantity, 5,547,203,913 cubic feet, or 6·7 per cent., were lost by leakage, &c.; leaving 77,412,024,591 cubic feet as the net production obtained and sold. As the quantity of gas made and sold at gas and bye-products works was 40,454,215,132 cubic feet, it appears that the consumption of water gas and gas produced from crude oil was nearly twice as much as that made from coal. It also appears that while the average price of coal gas in 1905 was 81·4 c. per 1000 cubic feet, that of oil and water gas combined was a fraction of a cent in excess of $1. Still further comparison shows that whereas 66 per cent. of the production of coal gas was sold as illuminating gas, 77 per cent. of the combined production of oil and water gas was used for this purpose.

*Coke.*—The total quantity of coke produced in retort or bye-products ovens and at gas-works in 1905 amounted to 5,751,378 short tons, valued at $18,844,866, against 4,716,049 short tons, valued at $14,693,126, in 1904, and 3,941,282 short tons, valued at $13,634,095, in 1903. Of the total product in 1905, 2,289,030 short tons, or 39·8 per cent., were produced at gas-works; and 3,462,348 short tons (60·2 per cent.) in retort-ovens. In 1904, the production of gas-works coke amounted to 2,107,820 short tons, and that of retort-oven coke to 2,608,229 short tons; whereas in 1903 the production of the former was 2,058,888 short tons, and of the latter 1,882,394 short tons. It will be seen from this that of the total increase in 1905 over 1904, 854,119 short tons, or 82·5 per cent., was in the production of retort-oven coke, and that compared with 1903 the output of this kind of coke has increased 83 9 per cent., while that of ordinary gas coke shows a gain of 11·18 per cent. The total quantity of coal carbonized or coked at gas-works and bye-products plants in 1905 was 8,187,812 short tons, of which 3,558,831 short tons were used at gas-works, and 4,628,981 short tons in retort-ovens. In 1904, the consumption was nearly equally divided—gas-works using 3,485,208 short tons, and retort-ovens 3,572,949 short tons. The average price per ton for the coke produced was $3·28 in 1905, against $3·12 in 1904.

Many gas companies are engaged also in the electric light business, and coke made at the gas-works, as well as a considerable quantity of tar, is used for firing in the electric light plants. Other producers of coal gas are also makers of water gas, and the coke from the retorts is used for firing the water-gas plant. Some coke is also used in the carbonization of coal at some of the gas-works. It will be noted, therefore, that not all the coke produced at gas-works in the United States is sold; a considerable quantity of it being consumed at the works where

it is produced. The total production is given as nearly as possible in these reports—the quantity consumed being arrived at as accurately as practicable; and the value placed upon it is the same as that received for the coke sold.

*Coal Tar.*—Coal tar, as the raw material from which is obtained creosoting oils, aniline dyes and salts, and innumerable organic chemical compounds and medicinal preparations, is of much more economic importance in some of the European countries than it is in the United States. America is considerably in the rear, particularly when compared with Germany, in the development of chemical industries based on coal tar, the products of which are imported to the value of several million dollars every year. At the present time, the treatment of coal tar in the United States is confined principally to the production of creosote, and of tars and tar pitches suitable for roofing papers, paving materials, &c. With the continued development of the retort-oven coking industry, however, and an assured supply of coal tar, there is every reason to believe that chemical industries dependent upon tar as a raw material will be established. The lack of such an outlet for one of the principal bye-products of retort-oven coke manufacture is in part responsible for the fact that the construction of bye-products coke-oven plants has not been more energetically pushed.

The statistics collected for the report show that in 1905 the total production of coal tar at gas-works and retort-oven plants was 80,022,043 gallons, valued at $2,176,944, against 69,498,085 gallons, valued at $2,114,421, in 1904. From this it appears that while the quantity of tar produced increased 10,522,958 gallons, or 15 per cent., the value increased only $62,523, or less than 3 per cent. When compared with the statistics for 1903, a still larger difference is shown; for while the production in 1905 was upwards of 17 million gallons, or more than 25 per cent. in excess of that of 1903, the value shows a decrease of $23,000. The average price per gallon at the works has declined from 3·49 c. in 1903 to 3·04 c. in 1904 and 2·72 c. in 1905. There were about 80,000 gallons unmarketed in 1904, and 160,000 gallons in 1905. The surplus was not large in either case; but it was sufficient to indicate a production in excess of the market requirements, the result of which is naturally shown in reduced values. The yield of tar per ton of coal consumed in 1905 ranged from 7·3 gallons in North Carolina to 13·2 gallons in Rhode Island. Prices varied from 1·9 c. per gallon in Michigan (in which State a surplus of 53,526 gallons was reported) to 10 c. per gallon in Oregon.

*Water-Gas Tar.* — The following figures give approximately the amount of water-gas tar produced and sold in the United States in 1905, and the price received for it at the works: Total sold, 9,230,411 gallons; unsold, 2,274,891 gallons; average price per gallon, 2·66 c. At many of the plants there is no market for this product, and it is consumed at the works, no record being kept of the output. Where companies produce both coal and water gas, the water-gas tar, if sold at all, brings a lower price per gallon than the coal-gas tar. While in many of the States there is a market for the latter tar, much of it is also consumed by the producing companies, particularly when they produce both coal and water gas. The production of water-gas tar is so small that it is scarcely worth consideration in a report.

*Ammonia.*—Only about one-fifth of the establishments producing gas and coke from coal report the recovery of ammonia, either in the form of ammoniacal liquor or as sulphate. Thus in 1905, out of a total of 529 establishments, the production of ammonia was reported by only 115. In the year 1904, ammonia production was reported by 117 establishments out of a total of 534; and in 1903, by 115 out of a total of 528. The 115 companies making returns in 1905 reported a total production of 46,986,268 gallons of ammoniacal liquor, valued at $1,728,254, and 38,663,682 lbs. of sulphate, valued at $997,452; against 52,220,484 gallons of liquor, worth $1,487,196, and 28,225,210 lbs. of sulphate, valued at $771,995, in 1904. The comparatively higher value of the liquor sold in 1905 was due largely to its greater average strength; for in 1904 the 52,220,484 gallons, reduced to anhydrous ammonia, represented an equivalent of only 19,750,032 lbs. of ammonia, while the 46,986,268 gallons produced in 1905 were equivalent to 22,455,857 lbs. The average price of the liquor was 7·7 c. per pound of ammonia in 1905, and 7·5 c. per pound in 1904.

The total quantity of coal carbonized at works reporting a production of ammonia in 1905 was 7,194,910 short tons, of which 6,298,783 tons were consumed at works producing ammoniacal liquor, and 896,127 tons at works reporting their production in the form of sulphate. In 1904 the quantity of coal carbonized was 6,115,588 short tons, of which 5,230,991 tons were consumed at works of the first-named class, and 884,597 tons at plants making sulphate of ammonia. The average yield of sulphate per ton of coal was 43 lbs. in 1905 and 32 lbs. in 1904. The average yield of the liquor, expressed as ammonia, was 3·57 lbs. in 1905, against 3·78 lbs. in 1904. The returns showed that ammoniacal liquor is sold in several ways. Some companies reported the production in liquor-ounces, selling at a certain price per 100 oz. of a specified strength; others reported their production in gallons, sales being made at a certain price per pound for pure ammonia; while others, again, reported the production in gallons of liquor at so much per gallon, giving the strength.

*Imports of Coal-Tar Products.*—There is little to add to what has previously been stated with regard to the slight progress in the manufacture of chemical products from coal tar which has been made in the United States. With an average annual production exceeding 60 million gallons of coal tar (over 80 million gallons in 1905), America is depending almost entirely upon Europe (principally Germany) for the coal-tar chemical products, and is importing millions of dollars' worth of aniline colours and salts, coal-tar medicinal products, &c., while the domestic manufacture is restricted largely to the production of creosote oils, and of tars and pitches used in the manufacture of roofing paper and for paving materials. The coal tar produced in America in 1902 was worth at first hand $1,873,966. In that year the coal-tar products imported into the United States were worth, at ports of shipment, $7,494,340. The duty paid on these imports amounted to $1,594,799; making the total cost, exclusive of freight, other expenses, and jobbers' profits, $9,089,139. The value of the coal tar produced in 1903 was $2,199,969, and $2,114,421 in 1904. In 1903 the value of these imports was $7,690,885; and the duty was $1,692,445—making a total of $9,383,330. In 1904 the imports were valued at $7,146,871; the duty was $1,578,647; and the total, $8,725,518. In 1905 the value of the coal tar produced was $2,176,944; and the imports, with duty added, were valued at $10,201,601. A conservative estimate would place the total value of these imports in the wholesale markets of America at $12,000,000 in each of the last three years.

## ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

### The Recent Explosion—Hostile Attitude of the Corporation.

The Half-Yearly General Meeting of this Company was held at the Offices, D'Olier Street, Dublin, on the 30th ult.—Alderman W. F. Cotton, D.L., J.P., in the chair.

The report presented by the Directors showed that the gross income in the six months ending the 31st of December last amounted to £153,801; the expenditure during the same period being £110,917; leaving a gross profit of £42,884. From this sum had been deducted £6257, interest on loan capital, &c.; leaving a net profit of £36,627. To this was added £1050 brought forward; making the total sum available for distribution £37,677. The Directors recommended the usual dividends of 10½ and 7½ per cent. per annum on the respective shares. Payment of these would absorb £36,907, and leave a balance of £770 to be carried forward.

The Chairman, in moving the adoption of the report and accounts, remarked that the report was very short; but he had no doubt that, when taken with the accounts, the proprietors would consider it satisfactory, notwithstanding that there had been a falling-off in the sale of gas. What with competition from electric lighting, the use of suction or power gas, and the almost universal use of incandescent burners, the Company were passing through times in which the use of gas could not be extended. Moreover, the great depression in trade throughout the city, and the extraordinarily mild, bright weather experienced during the last three months of the half year, considerably retarded the sale of gas. Consumers who had adopted incandescent gas lighting were aware of the great economy effected by it when compared with the old system of lighting by flat-flame burners. During the period covered by the accounts, there had been expended under the head of capital the sum of £12,677. This represented an outlay of £6544 on slot and ordinary meters, £3837 on mains and service-pipes, £1883 on cooking-stoves, and £410 on extensions, &c. There were brought into operation 3459 cookers, 529 heating-stoves and fires, and 2079 new automatic installations. With regard to the latter, he might mention that the demand for them was such that the Company found it difficult to cope with it. With the exception of a slight increase in receipts for coke, no improvement had taken place in the market for residuals since the last meeting; the other products being about the same as in the corresponding half of 1905. The Directors had under consideration the question of remodelling the retort-houses at the Brunswick Street station; and if they finally decided on carrying out the work, it was their intention to have them fitted with the most modern appliances, including provision for gaseous firing, which they had been informed was most effective in the carbonization of coal, and led to economy in the use of fuel. He regretted to say that a very sad accident, involving the loss of two lives and injury to a number of men, occurred on the works on the 10th of January. A body of men were engaged in turning oxide on the revivifying floor, over which were situated ten large purifiers at a height of about 17 feet. A large volume of gas escaped, resulting in an explosion and fire. No fire or light of any sort was near the purifiers, and the only way of accounting for the gas becoming ignited was that a spark was given off from an electric wire which passed under the purifiers—the wire being found, immediately after the accident, stripped and fused. The purifiers sustained considerable damage—one of them being so badly injured as to be past repair; and it was found absolutely necessary to throw most of them out of action and suspend the manufacture of gas for about 46 hours. Fortunately, they had a good stock of gas, which helped them, in some measure, to tide over the difficulty. The Directors lost no time in entering into a contract with the firm who originally erected the purifiers for their repair and reconstruction; and it was to be hoped that they would be completed within five or six weeks. The loss was covered by insurance. The proprietors would scarcely believe that, notwithstanding the difficult position the Company were placed in, a Committee of the Corporation determined to issue a summons against them for supplying (as alleged by their Inspector) gas of under the standard of 16 candles. One would reasonably have expected that the Company would have the sympathy of the Corporation, as he was sure would have been freely accorded in any other city in the kingdom. There might have been some cause for this action had the consumers suffered to any appreciable extent. This, however, was not the case. Turning to the accounts, the Chairman explained the financial position of the Company, and stated that, after payment of the dividends, a balance of £770 would remain to be carried to the next account. A sum of £2000 had been written off the suspense account, which was formed to meet the expenditure on the reconstruction and repairs to one of the gas-holders at the Barrow Street station, and £4438 off their automatic fittings, &c.

The Deputy-Chairman (Mr. John Murphy) seconded the motion; and, after a few remarks, it was carried.

The dividends recommended were then declared; and the proceedings closed with a vote of thanks to the Chairman, Directors, and officers for their services.

**New Filters at the Bolton Water-Works.**—There have lately been completed for the Bolton Water-Works, by Messrs. Mather and Platt, Limited, under the supervision of the Water Engineer to the Corporation (Mr. R. H. Swindlehurst, M.Inst.C.E.), some new filters at the Sweetloves reservoirs, which were formally opened a few days ago by the Chairman of the Water Committee (Mr. J. T. Cooper). There are ten filters, which can collectively deal with 3 million gallons of water in 24 hours; and from them the water flows to the settling-tanks for clarification before being sent down the streams. The cost of the works, including the building, filters, and tanks, was £5500.

## GAS PROFITS AT DARWEN.

### A Change of Policy.

At the Monthly Meeting of the Darwen Town Council last Thursday, there was a long discussion on the question of the allocation of the gas profits. Last May, Councillor Duxbury moved the following resolution: "That the automatic transfer of gas profits to the general district fund for the relief of rates, under the resolution passed by the Council on June 4, 1903, forthwith cease, and that the last clause of the resolution—viz., the words 'on attaining this reserve the profits of the gas-works shall automatically go to the relief of rates,' be struck out and rescinded." The resolution of the Council referred to was: "That the estimates be adopted, and that the sum of £500 be allocated out of gas profits in reduction of the adverse balance on district rate account; and that after allocating out of the gas profits the sum of £500 in reduction of the adverse balance on district rate account, no further money shall be taken from the gas profits till the reserve fund stands at £5000. On attaining this reserve, the profits of the gas-works shall automatically go to the relief of the rates." On that occasion, Mr. Duxbury was unsuccessful in carrying his proposal; but he returned to the charge last week with a better result.

Mr. DUXBURY, in moving his resolution, said that the arguments used on the last occasion by Alderman Tomlinson (who was the main cause of the Council's action in the past) were (1) That as the money was borrowed at the risk of the ratepayers, the ratepayers would have to pay it back to the loan holders if anything happened to cause the gas-works to be of no value. (2) Everybody had to contribute out of the municipal fund to maintain the sinking fund of the cemetery, seeing that the income did not cover the outgoings. (3) Everybody had to contribute to the parks, though some people might not use them. (4) That it was a fair thing, and what obtained in practically any other town. He (Mr. Duxbury) challenged these assertions, and pointed out that the Parliamentary Returns showed 211 gas-works in England as belonging to municipal authorities (only a small portion of whom milk their gas consumers); and 467 gas-works are owned by companies who do not hand over any of their profits to the rates—showing in the whole of the country a comparatively small proportion of towns that rob their gas consumers in order to cover their extravagant expenditure in other departments. What had the Darwen gas consumers done up to March, 1906—the last published return? They had paid all the costs of making gas, and had handed over to the ratepayers £296,044 gross profits since the town bought the works in the year 1872. The consumers had paid the old Gas Company's shareholders' annuities, £92,950; interest on all loans, £72,161; sinking funds, £86,000; to rates and other purposes, £37,300. The town paid £47,394 for the gas-works in 1872, and since then the gross profits had been £296,000. Where was the risk? The last published balance-sheet (March, 1906) showed the amount transferred from gas profits to rates as £1547 for that year, which was equal to about 3d. per 1000 feet and 3d. in the pound on the rates. So that places of worship and charitable institutions (non-rated) were made to pay rates in their gas bills. A shopkeeper using gas had to pay 7s. or 8s. towards the rates of his next door neighbour, who used electricity and no gas. Small users of gas-engines were paying about £2 16s. each per year towards other people's rates, besides paying their own rates. Four ratepayers using some gas paid extra for gas at 3d. per 1000 £22 11s., but saved in rates at 3d. in the pound £100 6s. 2d.; so that of these four people's rates, £77 15s. 2d. was paid by other gas consumers. The 6000 poor people living in cottages under £8 rateable were paying 2s. 3d. each annually extra for gas; and this went to reduce the rates payable by their landlords, of whom about 150 were absentee landlords residing out of town. There were about 600 houses in the town where gas was not used; and these also got their share of the profits. Besides this, all the better class houses and large works where electricity was employed were pocketing money paid by gas consumers. In 1902, the gas-works made a loss of £3800; and still they transferred £1000 from "gas profits," and raised the price of gas 3d. per 1000 feet. Through this increase in price they had to pay more income-tax, and the rateable value was increased until the rates paid were the highest but one out of a list of 114 gas-works of which statistics had been published. If Alderman Tomlinson wished to deal straight in this matter, why not send in a separate additional bill for the general district rate at 3d. in the pound to all those who used gas only, instead of charging 3d. extra for gas; and then let him come before the electors next November. When the resolution was passed in June, 1903, at the Finance Committee, there were in attendance only seven members of the present Town Council; and when it was confirmed at the Council meeting, there were present only thirteen members of the Council now existing, all of whom were not in favour of it. They would therefore see that the change in the *personnel* of the Council was such that one-half of the present members were not on the Council when this resolution was passed. He did not know a single case in the country where a council had passed a resolution of this kind binding their successors; and he again asked them to rescind the part of the resolution which automatically transferred gas profits to the rates. If afterwards they wanted to transfer such profits, then they might bring the matter forward openly on each occasion, as was done in every other town where this pernicious and unjust practice was pursued.

Mr. JAMES TOMLINSON having seconded,

Alderman TOMLINSON said that, strange as it might appear, he was going to support the resolution, in view of the *addendum* to Mr. Duxbury's speech, to the effect that at their next meeting, when they knew the amount of the profits on the gas-works, they could deal with them and allocate them as the Council might see fit. He still adhered to the statement that all municipalities, without exception, that owned their trading concerns, allowed the profits of the concerns to go into the rates. There was no other legal way of treating the surpluses. Locally, there was a special reason why they should utilize the profits from trading concerns in this manner, because they had several debit balances in the district fund, the borough fund, the cemetery, &c.—the total being a considerable one. These debit balances ought to be cleared; and they would, he hoped, be largely cleared by the profits from the trading concerns. Otherwise they would have to be cleared off by an advance in the rate. The most intelligent and the largest municipalities in the country had for years and years paid very large sums out of their trading profits to the ratepayers, who, after all, were the people who were called upon to make good any losses there might be on the gas-works. The ratepayers were the ultimate guarantors for the loans, and not the consumers. A month hence they would see what support they got from Mr. Duxbury in allocating the very ample profits which he hoped would be found to have accrued from the gas-works.

Several other speakers took part in the discussion—all being in favour of Mr. Duxbury's proposition, which was then agreed to.

## GERMAN CONTINENTAL GAS COMPANY.

### Report and Accounts.

We have received, through the courtesy of Herr W. von Oechelhaeuser, the General Manager, a copy of the annual report and statement of accounts of this Company for the year 1906. They were submitted to the fifty-second annual general meeting of the shareholders, held at Dessau on the 27th ult.

The report states that the favourable condition of industry in Germany resulted in an increased output of gas from the Company's German works; but there was a decrease at Warsaw. As compared with 1905, the make at all the German works increased by 5·82 per cent., and at Warsaw decreased by 2·09 per cent.; giving for the whole of the Company's field of operations an increase of 1·91 per cent., as compared with an increase of 0·31 per cent. in the preceding year. The profit from the Warsaw works decreased very much, owing to the continued state of unrest in Russian Poland. The persistent threatening of the Company's officers at Warsaw by the workmen, which was not stopped by the granting of several considerable increases of wages and numerous other benefits, led to many assaults and outrages, and culminated in the assassination of Herr A. Welke, the Manager of the second of the Company's works there. Consequently, military occupation of the works again had to be resorted to in November; and orderly relations with the workmen were only restored by the close of the year. The reduced consumption of gas at Warsaw was attended by increased expenses in the direction of higher rates of wages and the employment of more hands, as it proved impracticable, under the prevailing conditions, to get rid of the men normally not required in the summer months. The long military occupation of the works also involved considerable outlay. The profits from the Company's chemical works and fitting business in the city were also reduced through the unfavourable political and commercial situation. Further, under the new concession for Warsaw, the Company had last year for the first time to pay the Municipality a largely increased sum. As a result of the decrease in the Warsaw profits, the Company's total profits show a falling off of 702,003·69 marks (about £34,410), as compared with the preceding year, in which it will be remembered there was a falling off from the same cause of about £13,700. The profit for the past year amounted to 2,388,331·55 marks (about £117,075). From July 1 last, an increase of 3,000,000 marks in the issued stock of the Company began to rank for dividend. For these and other reasons—some extraordinary, and some applying this year for the first time—the dividend at the rate of 10 per cent. per annum which had been declared annually since 1902, cannot be maintained for 1906. A dividend at the rate of 8 per cent. per annum is now proposed, leaving the sum of 73,264·89 marks to be carried forward to this year's account. The prospects for the current year are more favourable, provided the political conditions in Russia continue quiet. New contracts have been arranged for the lighting of the town of Herdecke from the Hagen-Eckesey works, and the community of Golm from the Potsdam works of the Company.

The past year has witnessed, the report says, the consummation of an important technical and economical advance in gas lighting, in that the inverted gas-burner has been rapidly adopted. The distribution of light downwards is far more favourable with this burner. There is, compared with the earlier incandescent burners, an economy of 30 to 40 per cent. in the gas consumed; while an electrical means of igniting and extinguishing is commonly applied with it. Lamps containing several inverted burners, and yielding a light of 200 to 500 candles, have proved very satisfactory for lighting shop-windows and public places. In heating by gas, an important innovation has taken place in the supply of flats and houses with hot water from one central gas heating apparatus.* This apparatus has been patented by the Company, and is made at their Dessau shops.

The Dessau Vertical-Retort Company, founded by this Company, have made good progress during the year, having obtained orders from a large number of gas-works at home and abroad for settings on the new system. The system has done well at the Dessau and Potsdam works, and confirmed the expectations which earlier results aroused. The new settings in particular result in a considerable lightening of the manual labour.

The gas made in all the works of the Company amounted to 69,538,992 cubic metres, or an increase of 1·91 per cent. on the make for 1905. Of the total make, 74·21 per cent. was disposed of for lighting, and 20·27 per cent. for heating, cooking, and engines; while the remaining 5·52 per cent. was unaccounted for. There was a small increase in the length of mains.

* See "JOURNAL," Vol. XCIV., p. 928.

**Increased Price of Gas at Cromer.**—In consequence of the rise in the price of coal, the Directors of the Cromer Gas Company have increased the price of gas by 4d. per 1000 cubic feet, as from the 1st inst.

**The Chester Workhouse Water Supply Case to be Appealed.**—At a meeting of the Chester Board of Guardians last Tuesday, it was decided to appeal against the judgment of Mr. Justice Jelf in the action brought by the Chester Water Company against the Guardians, as reported in the "JOURNAL" for Jan. 22, p. 229.

## WIGAN AND WATER GAS.

At the March Meeting of the Wigan County Borough Council, the Gas Committee brought forward a proposal, on the recommendation of the Engineer (Mr. J. Timmins), to put down an installation of carburetted water-gas plant of 600,000 cubic feet a day capacity; but after some discussion, this portion of the minutes was referred back for reconsideration.

When the Council met again last Wednesday, Alderman Holmes, J.P., the Chairman of the Gas Committee, pointed out the need there was to prepare themselves to meet the growing demand for gas, and said that, in view of the discussion that had already taken place, he had asked the Engineer to further report on the proposed carburetted water-gas plant. This report they now had; and it was quite clear to everyone that there was no justification for the fear expressed at their last meeting. The amount of water gas that it was proposed to introduce with the coal gas was only 20 per cent., and was considerably below the limit suggested by the Home Office Departmental Committee. This ought to be completely satisfactory. There was another item he wished to call their attention to. It was considered necessary to increase their purifying capacity if possible before next winter, by putting down two new purifiers. This would cost £1750; and with the sum for mains and services referred to at the last meeting, it made a total outlay of something like £23,000. It was absolutely necessary; and, under the circumstances, he hoped the Council would not hesitate for one moment in supporting the Committee in their work.

The confirmation of the Committee's minutes having been proposed and seconded, Mr. M'Quaid remarked that the latest report of the Gas Engineer was a little more reassuring. Of course, he was not going to say the report was not correct; but he was a little surprised to hear that more fatalities had occurred from escapes of coal gas than from escapes of carburetted water gas. It might be so—he had no statistics to disprove it—still he was a little bit sceptical. He knew they had heard of more fatalities from carburetted water gas than from coal gas—in later years at least. The suggestion was that on no account should more than 20 per cent. of carburetted water gas be added to the coal gas. It was all very well to say this now; but there might be a time when the temptation would be to mix a higher percentage. The fact of having a plant there, and making carburetted water gas, would always be a temptation to mix more than 20 per cent. Were they sure it would never be departed from? In reply to this, Alderman Gee pointed out that it would be absolutely impossible with the plant they were putting down to introduce even 20 per cent. of carburetted water gas into their present output. It seemed to him that the Committee were pursuing a very wise course; for unless they took the matter in hand at once, before the foggy autumn months came, there was a danger in Wigan that they might have a shortage in their supply of gas, and they had no idea what a dislocation of trade would follow such an eventuality. Dr. Benson said that if they had had the exhaustive report appearing on the minutes before them at the last meeting, he certainly should never have raised any objection. He was perfectly satisfied that what the Gas Engineer recommended was the right and best thing.

The minutes were then passed.

## GAS SUPPLY IN SHANGHAI.

### Annual Report of the Shanghai Gas Company.

According to the latest annual report of the Shanghai Gas Company, Limited, covering the twelve months ending the 31st of December last—the 43rd report issued since the origin of the Company—continued prosperity attended the business in the twelve months. The revenue from gas was 511,941 taels; from the sale of residual products, 100,585 taels; and the profit on fittings was 9473 taels—making a total of 621,999 taels. The expenditure on the manufacture of gas was 337,539 taels; distribution, 32,149 taels; management and general charges, 36,696 taels—making a total of 406,384 taels. The profit on the year's working consequently amounted to 215,615 taels, which sum was transferred to the profit and loss account. The net profit was 202,361 taels. The balance at the credit of the profit and loss account, after crediting the account with 6093 taels brought forward after appropriation of the profits of the previous year, and deducting the amount of the interim dividend at the rate of 7 per cent., was 152,454, which the Directors recommended should be allocated as follows:—

| | Taels. |
|---|---|
| Final dividend at the rate of 7 per cent. per annum (making 14 per cent. for the year) | 56,000 |
| Dividend on new shares (two months, at 14 per cent.) | 9,147 |
| Bonus on old shares | 24,000 |
| Do. on new shares | 1,989 |
| Depreciation of land and buildings, plant, and furniture | 53,328 |
| To be carried forward | 7,990 |
| Total | 152,454 |

The private consumption of gas increased last year to the extent of 51,806,675 cubic feet, or 14·42 per cent.; and there was a small increase (2·96 per cent.) in the quantity used for public lighting. There were 11 additional gas-engines fixed; making a total of 98 in use. The increase in the quantity of gas employed was 5,812,800 cubic feet, or 16·32 per cent. There were 3966 tons 11 cwt. more coal carbonized, and 53,298,600 cubic feet more gas produced, last year than in 1905. The residuals were sold favourably, and there was a considerable augmentation in the revenue.

In the course of his report to the Directors, the Engineer-in-Chief (Mr. H. King Hiller) furnished the following particulars: The quantity of coal, &c., carbonized was 37,942 tons 5 cwt. 2 qrs.; and the production of gas was 447,992,100 cubic feet, or at the rate of 11,807 cubic feet per ton. The gas sold was 420,949,800 cubic feet—being an increase of 15·37 per cent. on the sale in 1905; and the quantity used on the works and unaccounted for was 27,042,300 cubic feet. There were 7·66 miles of new and enlarged mains laid during the year.

## INCANDESCENT LIGHTING IN BELFAST.

A report on incandescent street lighting was recently submitted to the Belfast Gas Committee by Mr. R. Sharpe, the Manager, who pointed out that hitherto they had not followed any definite plan in converting the flat-flame burners to incandescents. This practice, he said, did not tend to uniformity; and in any proposed scheme of conversion, it would be desirable that the work should be systematically done in sections. He would propose to start from Castle Junction as a centre, and work outwards—completing a half-mile circle each year until the whole work was finished. This method of spreading the work over a term of years had been adopted in Glasgow, Edinburgh, and Birmingham, with very satisfactory results. In the case of Glasgow, four years would be occupied in making the change, and in Edinburgh and Birmingham five years. They had an order from the Police Committee to proceed with the alterations to the lamps on the tramway routes at once; and they could not do so until the Gas Committee decided on the pattern of lamp to be adopted. Mr. Sharpe recommended to the notice of the Committee a pattern which was suitable alike for vertical or inverted burners, which had no patent rights, and which could be made in their own workshops at the rate of a hundred a week. With reference to the question of converting existing lanterns, he instanced a street in which this had been carried out at a cost of 10s. 1d. each, while to rebuild the lanterns cost 14s. 4d. He pointed out, however, that only about one-half the lamps could be altered, as many of them would be found too much worn to admit of anything but rebuilding. Assuming, therefore, that one-half the lamps would have to be altered, the average cost would be 12s. 3d. per lamp; thus leaving a difference of 1s. 1d. between the cost of old and new lanterns. This extra cost was so small that he had no hesitation in recommending the new pattern. Two schemes for carrying out the change were set out in the report.

The Committee recommended that the work should be spread over five years at a total cost of £10,000; and when the minutes containing this recommendation came before the Council, they were unanimously adopted.

## HORSFORTH WATER SUPPLY.

### Opening a New Pumping-Station.

The new pumping-station which has been constructed for the Horsforth Urban District Council by Mr. E. J. Silcock, M.Inst.C.E., of Leeds, was formally opened a short time ago by Mr. J. W. Rathmell, the Chairman of the Water Committee of the Council, and Mr. C. Braithwaite, the Vice-Chairman (the latter starting the pump), in the presence of a numerous company. After the ceremony, the party took tea, on the invitation of the two last-named gentlemen, in the offices of the Council. At the close of the repast, Mr. Rathmell gave a history of the water undertaking from the date of its purchase in 1899, and referred in terms of high commendation to the Manager of the Works (Mr. Robert R. Jones), for special services he had rendered in utilizing the available water during a period of great scarcity. Mr. Silcock followed with some additional particulars. He said the supply of water to the district was originally undertaken by the Horsforth Water-Works Company, who constructed in the year 1867 two reservoirs on the Scotland Beck. In 1887, a third reservoir was built; and subsequently, in 1895, the middle reservoir was enlarged. These three reservoirs had a gathering-ground of about 215 acres, and a total capacity of about 42 million gallons. The works were purchased from the Company by arbitration; the price fixed by the Umpire being £42,000, in round numbers. In 1901, he was instructed by the Council to advise them as to the best means of increasing the supply; and he recommended the sinking of a borehole in an area he indicated. A contract was accordingly entered into for a boring 12 inches in diameter and 500 feet deep; but when a depth of 439 feet had been reached a test was made, and an average yield of 175,000 gallons per day obtained. The quantity was limited by the capacity of the pumps temporarily put down; and he therefore submitted to the Council plans for a pumping-station in which steam power was to be utilized. About this time suction-gas plants were being perfected, and there was a strong feeling in the Council in favour of using this form of power. Alternative plans were consequently prepared for a gas-driven plant. The scheme was ultimately adopted by the Council and approved by the Local Government Board; and the result had been the production of the plant which the company had just inspected. It consisted of a pump, 9 inches in diameter and 3-feet stroke, capable of delivering 9000 gallons of water per hour from a depth of 300 feet into the middle reservoir. It was driven by a "National" gas-engine of 32 H.P., supplied with gas by a suction-gas producer, and also, as an alternative, with gas drawn from the mains of the Calverley and Horsforth Gas Company. The water was delivered from the pumps into the reservoir by means of an 8-inch iron main, which was laid by the Council by administration—utilizing unemployed labour in the township. The total cost of the works, including every charge, was somewhat less than £4500. For this capital cost, the Council had put themselves in a position to supply to their district 200,000 gallons of water per day, in addition to the 120,000 gallons supplied from the old works. As the consumption of the township was at present about 150,000 gallons per day, the Council had made provision for a very large increase in the population; and they had at their disposal sufficient water to supply the district for many years to come. In conclusion, he said the policy of the Council in purchasing the water-works had been fully justified, as they had obtained an undertaking the cost of which would be gradually paid off without increasing the cost of water to the consumers, and they had saved a large capital expenditure by adopting the borehole supply. They were to be congratulated upon the possession of excellent water-works, and to be complimented upon the businesslike way in which they had dealt with the question. A hearty vote of thanks was accorded to Messrs. Rathmell and Braithwaite, whose health was proposed and duly honoured; and this brought the proceedings to a close.

## LINCOLN CORPORATION WATER SUPPLY.

### The Unsuccessful Boring at Boultham.

At the Meeting of the Lincoln City Council, sitting as the Sanitary Authority, last Tuesday, the Water Committee stated in their minutes that a letter had been received from the Town Clerk of Newark, saying that the Corporation would be prepared to offer Lincoln 500,000 gallons of water a day for a term of years (see *ante* p. 44). It was resolved that the Corporation be informed that the quantity offered was not sufficient for the requirements of Lincoln, and that in consequence the negotiations would not proceed. In moving the adoption of the minutes, the Mayor (Colonel J. S. Ruston) said he thought it might be expected of him to make a few remarks on the subject of the general water supply. On the whole, he thought they might congratulate themselves that the water in the service-pipes continued to be entirely safe. They knew that the bore had been given up, not proving satisfactory. When the quality of the water became gradually worse, they took expert advice as to whether to stop the bore or to go on. After the experts had considered the matter, they thought it desirable to go another 200 feet. They accordingly did so; but there was no improvement. It became rather worse, and they intended to let the water run to waste. It might improve in quality, but he thought this was hardly possible; and it was a matter of little importance, in view of the present requirements. He could assure the people outside that they had not been dallying with the question. They instructed their Engineer to get information as to available sources of supply; and he had presented a report. The offer of the South Lincolnshire Water-Works Company was discussed at great length; but they had unfortunately to give an answer in the negative. The water was not of the quality which would be suitable for Lincoln—the analysis showing that the total hardness was 27·6 degrees. There were other schemes at present before the Council; but delicate negotiations would have to be conducted, and he did not think they should be discussed. The citizens would have an opportunity of expressing an opinion upon the matter before the Council launched upon any scheme. Mr. Ruddock seconded the motion, and expressed his sorrow that the bore had not been successful. It would be remembered, he said, that between five and six years ago they undertook the work with the object of obtaining a million gallons of water per day. Now it was found that, apart from the quantity, the quality was not what was desirable. They were all sorry that so many thousands of pounds had been spent; but they acted on the best advice, and could only express regret at the result.

## HULL CORPORATION WATER SUPPLY.

### Mr. F. J. Bancroft's Annual Report.

The Water and Gas Engineer of the Hull Corporation (Mr. F. J. Bancroft, B.Sc., Assoc.M.Inst.C.E.) recently issued his tenth annual report on the water supply to the city. He points out that the rainfall at Pearson Park during the past year was 25·46 inches; being 94 per cent. of the 30 years' average, which is 27·02 inches. The rainfall on the Wolds—the gathering-ground for Hull—was 25·34 inches, or practically the same as at Pearson Park. Of the total quantity of water supplied, Springhead gave 38 per cent. and Cottingham 62 per cent.; the yield from Cottingham being greater than for any previous year. This resulted from the continuous pumping necessary for driving the extension of adits at Cottingham. The draught on the wells at the two pumping-stations will now be more equally divided. The greatest quantity of water supplied by each station in one day during 1906 was as follows: Springhead, 6,520,000 gallons, Aug. 2; Cottingham, 7,822,000 gallons, June 5. The area of the district within which the Corporation are authorized to supply water is the same as before—viz., 16,377 acres, or 25·59 square miles. In addition, they supply water in bulk to the Cottingham Urban District Council, and also to the Sculcoates Rural District Council for the Sutton district. The highest level at Springhead was 56 feet (April 25), and the lowest 30 feet (Jan. 17). At Cottingham, the figures were: Highest, 42 feet (Dec. 19); lowest, 6 feet (Sept. 12). During the year, 50,266 feet, or 9½ miles, of new mains were laid and 180 fire-hydrants fixed. As 25,421 feet of mains were taken up and disused, there was a net increase of 24,845 feet, or 4·71 miles. The total length of mains on Dec. 31 last was 249·83 miles. The estimated average population supplied within the water limits in the past year was: Inside the city boundary, 262,400; outside the city, 5100—total, 267,500. During the past year, more water was pumped into the city than ever before in the history of the water undertaking—viz., 3490 million gallons; of which quantity 23,401,000 gallons were supplied to Cottingham and Sutton. The remainder is equivalent to a daily supply throughout the water limits of 9,498,000 gallons, or 35·5 gallons per head per day. After making a further deduction for the water used for trade purposes, the water furnished for domestic purposes equals 27·12 gallons per day for each inhabitant of the city and district. This is a slight increase on the quantity used in 1905, which was 26·53 gallons per head per day. The water supplied by measure was 818,501,000 gallons, or an increase of 35 millions upon the meter supply in the preceding year. The following are some additional figures from a comparative annual statement accompanying the report: Meters in use, 1215; average meter supply per diem (313 days), 2,615,000 gallons; domestic and unmetered trade supply (average per diem), 7,255,000 gallons; greatest output during the year, 11,795,000 gallons (Aug. 2).

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At the annual meeting of Messrs. James Milne and Son, Limited, on Friday, the Directors will report that the net profit for the year, after meeting all business charges, providing for depreciation, and including the balance brought forward, amounts to £2967. Deducting the arrears of contingent salary due to two of the Managing-Directors on the 1904 account (£500), there remains a disposable balance of £2467, from which the Directors recommend the payment of a dividend of 2½ per cent. on the preference shares for the year ending Dec. 31, 1905, amounting to £2375, leaving £92 to be carried forward. Referring to the fire which occurred at the Milton House works on the 22nd of December, which completely destroyed the brass-finishing shop, the Directors state that the actual loss was covered by insurance, and that the Company liable promptly settled the claim. The consequential loss through dislocation of business will, it is hoped, soon be compensated by the introduction of improved machinery, including an installation of suction-gas plant, which is a much cheaper source of power than steam.

## GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 77.

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | £ s. d. |
| 500,000 | 10 | Oct. 12 | 10½ | Alliance & Dublin 10 p.c. | 21–22 | .. | 4 15 5 |
| 268,324 | 10 | ,, | 7½ | Do. 7 p.c. | 14½–15½ | .. | 4 16 9 |
| 200,000 | 5 | Nov. 14 | 7 | Bombay, Ltd. | 6½–7½ | .. | 4 16 7 |
| 40,000 | 5 | ,, | 7 | Do. New, £4 paid | 5–5¾ | .. | 5 1 10 |
| 50,000 | 10 | Feb. 28 | 14 | Bourne- mouth Gas and Water 10 p.c. Pref. 6 p.c. | 27½–28½ | .. | 4 18 3 |
| 51,810 | 10 | ,, | 7 | Brentford Consolidated | 16½–17 | .. | 4 2 4 |
| 53,200 | 10 | ,, | 6 | Do. New | 14½–15½ | .. | 3 17 5 |
| 380,000 | Stk. | ,, | 12½ | Do. 5 p.c. Pref. | 250–255 | .. | 4 18 1 |
| 300,000 | ,, | ,, | 9½ | Do. 4 p.c. Deb. | 190–195 | .. | 4 17 5 |
| 50,000 | ,, | ,, | 5 | Brighton & Hove Orig. | 117–122 | .. | 4 2 0 |
| 206,250 | ,, | Dec. 13 | 4 | Do. A. Ord. Stk. | 101–104 | .. | 3 16 11 |
| 220,000 | Stk. | Mch. 14 | 11½ | British | 220–225 | .. | 5 0 0 |
| 246,320 | ,, | ,, | 8½ | Bromley, Ord. 5 p.c. | 160–165 | .. | 5 0 0 |
| 460,000 | 20 | Sept. 27 | 10 | Do. do. 3½ p.c. | 42⅜–43½ | .. | 4 11 11 |
| 104,000 | Stk. | Feb. 28 | 6 | Buenos Ayres (New) Ltd. | 119–122 | .. | 4 18 4 |
| 165,700 | ,, | ,, | 4½ | Cagliari, Ltd. | 11⅛–12 | .. | 5 16 8 |
| 500,000 | 10 | Oct. 12 | 7 | Cape Town & Dis., Ltd. | 90–93 | .. | 4 16 9 |
| 250,000 | Stk. | Dec. 13 | 4 | Do. 4 p.c. Deb. | 93–95 | .. | 4 4 3 |
| 150,000 | 20 | Mch. 14 | 8½ | Do. 4½ p.c Pref. | 23–25 | .. | 6 12 0 |
| 100,000 | 10 | Sept. 27 | 10 | Do. 6 p.c. 1st Mort. | 14–15 | .. | 6 13 4 |
| 100,000 | 10 | Oct. 26 | 4½ | Do. 4½ p.c. Deb. Stk. | 8½–9½ | .. | 4 14 9 |
| 50,000 | 50 | Nov. 2 | 6 | Chester 5 p.c. Ord. | 51–53 | .. | 5 13 2 |
| 50,000 | Stk. | Dec. 28 | 4½ | Commercial 4 p.c Stk. | 56–98 | .. | 4 11 10 |
| 157,150 | Stk. | Feb. 28 | 5 | Do. 3½ p.c. do. | 109–111 | .. | 4 10 1 |
| 1,443,280 | Stk. | ,, | 5⅛ | Do. 3 p.c. Deb. Stk. | 107–110 | .. | 4 14 6 |
| 560,000 | ,, | ,, | 5 | Continental Union, Ltd. | 105–108 | .. | 4 12 7 |
| 475,000 | ,, | Dec. 13 | 3 | Do. 7 p.c. Pref. | 83–85 | .. | 3 10 7 |
| 800,000 | Stk. | ,, | 6½ | Derby Con. Stk. | 120–123 | .. | 5 5 8 |
| 200,000 | ,, | ,, | 7 | Do. Deb. Stk. | 138–143 | .. | 4 17 11 |
| 460,170 | Stk. | Aug. | 5½ | European, Ltd. | 122–124 | .. | 4 8 9 |
| 55,000 | ,, | Jan. | 4 | Do. £7 10s. paid | 103–105 | .. | 3 16 2 |
| 486,090 | 10 | Jan. 31 | 11 | Gas-light and Coke 4 p.c. Ord. | 24–25 | .. | 4 8 0 |
| 354,060 | 10 | ,, | 11 | Do. 3½ p.c. max. | 18–19 | .. | 4 6 10 |
| 15,203,110 | Stk. | Feb. 14 | 4⅘ | Do. 3 p.c. Con. Pref. | 95–97 | .. | 4 10 10 |
| 2,600,000 | ,, | ,, | 3½ | Do. Con. Deb. | 87–89 | .. | 3 18 8 |
| 3,799,735 | ,, | ,, | 4 | Hastings & St. L. 3½ p.c. | 105–107 | .. | 3 14 9 |
| 4,193,975 | ,, | Dec. 13 | 3 | Do. do. 5 p.c. | 83–85 | .. | 3 10 7 |
| 258,740 | Stk. | Mch. 14 | 5 | Hongkong & China, Ltd. | 95–100 | .. | 5 0 0 |
| 82,500 | ,, | ,, | 6½ | Imperial Continental | 116–119 | .. | 5 9 3 |
| 70,000 | 10 | Oct. 12 | 11 | Do. 3½ p.c. Deb. Red. | 19½–20½ | .. | 5 7 4 |
| 4,940,000 | Stk. | Nov. 14 | 8 | Lea Bridge Ord. 5 p.c. | 93–95 | .. | 3 13 8 |
| 473,600 | Stk. | Feb. 14 | 3½ | L'rpool Unit'd Deb. Stk. | 117–122 | .. | 4 18 4 |
| 184,602 | Stk. | Mch. 14 | 6 | Liverpool United A | 110–112 | .. | 3 11 5 |
| 306,083 | ,, | Dec. 28 | 4 | Do. B. | 223–225 | .. | 4 8 11 |
| 561,000 | Stk. | Feb. 28 | 10 | Maidstone 5 p.c. | 164–165 | .. | 4 4 10 |
| 718,100 | ,, | ,, | 7 | Malta & Medn., Ltd. | 142–147 | .. | 5 3 8 |
| 144,140 | Stk. | Feb. 14 | 7½ | Met. of 5 p.c. Deb. | 4¼–4¾ | .. | 5 5 3 |
| 75,000 | 5 | Nov. 29 | 5 | Melbourne 4½ p.c. Deb. | 100–102* | +1⅛ | 4 18 0 |
| 560,000 | 100 | Apl. 2 | 5 | Monte Video, Ltd. | 100–102* | +1½ | 4 8 3 |
| 250,000 | 100 | ,, | 4½ | Newc'tle & G'tesh'd Con. | 11½–12½ | .. | 5 12 0 |
| 541,920 | 20 | Nov. 14 | 3½ | Do. 3½ p.c. Deb. | 104–106 | –2 | 4 7 3 |
| 1,775,892 | Stk. | Feb. 28 | 4⅝ | North Middlesex 10 p.c. | 96–97 | .. | 3 12 2 |
| 406,025 | Stk. | Dec. 28 | 3½ | Do. 7 p.c. | 19¼–20½ | .. | 4 17 7 |
| 15,000 | 10 | Feb. 28 | 10 | Oriental, Ltd. | 13–14 | .. | 5 0 0 |
| 55,940 | 10 | ,, | 7 | Ottoman, Ltd. | 150–155 | .. | 5 3 3 |
| 300,000 | Stk. | Nov. 29 | 8 | Primitiva Ord. | 6–6¼* | .. | 5 7 8 |
| 60,000 | 5 | Mch. 27 | 7 | Do. 5 p.c. Pref. | 7⅛–8 | .. | 4 7 6 |
| 398,490 | 5 | Oct. 26 | 7 | Do. 4 p.c. Deb. | 5–5½ | .. | 4 15 3 |
| 796,980 | 5 | Jan. 31 | 5 | River Plate Ord. | 4 2 6 | | |
| 488,900 | 100 | Dec. 1 | 4 | Do. 4 p.c. Deb. | 12½–13½ | .. | 6 0 0 |
| 851,070 | 10 | Oct. 12 | 8† | San Paulo, Ltd. | 95–97 | .. | 4 2 6 |
| 300,000 | Stk. | Dec. 28 | 4 | Do. 5 p.c. Deb. | 12⅛–13* | .. | 6 3 1 |
| 250,000 | 10 | Mch. 27 | 8 | Sheffield A | 48–50 | .. | 5 0 0 |
| 125,000 | 50 | Jan. 2 | 5 | Do. B | 244–246 | .. | 4 1 4 |
| 135,000 | Stk. | Mch. 14 | 10 | Do. C | 244–246 | .. | 4 1 4 |
| 209,984 | ,, | ,, | 10 | South African | 244–246 | .. | 4 1 4 |
| 523,500 | ,, | ,, | 10 | South Met., 4 p.c. Ord. | 15½–16½ | .. | 6 1 3 |
| 70,000 | 10 | Oct. 26 | 10 | Do. 3 p.c. Deb. | 120–123 | .. | 4 9 5 |
| 6,350,000 | Stk. | Feb. 14 | 5½ | South Shields Con. Stk. | 84–86 | .. | 3 9 9 |
| 1,895,445 | ,, | Jan. 16 | 3 | S'th Suburb'n Ord. 5 p.c. | 154–156 | .. | 5 2 7 |
| 201,720 | Stk | Mch. 14 | 8 | Do. 5 p.c. Pref. | 120–123 | .. | 4 9 5 |
| 605,000 | Stk. | Feb. 28 | 5½ | Do. 5 p.c. Deb. Stk. | 120–123 | .. | 4 1 4 |
| 60,000 | ,, | ,, | 5 | Southampton Ord. | 125–130 | .. | 3 16 11 |
| 117,058 | ,, | Jan. 16 | 5 | Tottenham A 5 p.c. and B 3½ p.c. | 107–112 | .. | 4 9 3 |
| 502,310 | Stk. | Nov. 14 | 5 | Edmonton 4 p.c. Deb. | 123–126 | .. | 5 3 2 |
| 120,000 | Stk. | Feb. 28 | 6½ | Tuscan, Ltd. | 101–103 | .. | 4 17 1 |
| 398,940 | ,, | ,, | 5 | Do. 5 p.c. Deb. Red. | 101–103 | .. | 3 17 8 |
| 137,500 | ,, | Dec. 28 | 4 | Tynemouth 5 p.c. max. | 10½–11 | .. | 7 5 6 |
| 182,380 | 10 | ,, | 8 | Wandsworth A 5 p.c. and B 3½ p.c. and C 3½ p.c. | 102–104 | .. | 4 16 2 |
| 149,900 | 10 | Jan. 2 | 5 | Do. 5 p.c. Deb. Stk. | 104–106 | .. | 4 14 4 |
| 193,742 | Stk | Feb. 28 | 5 | Do. 4 p.c. Deb. Stk. | — | .. | — |
| 30,000 | Stk. | Feb. 14 | 8 | Do. 5 p.c. Pref. | 120–123 | .. | 4 1 4 |
| 255,636 | ,, | ,, | 6½ | West Ham 5 p.c. Ord. | 101–104 | .. | 4 18 6 |
| 75,000 | ,, | ,, | 5⅝ | Do. 5 p.c. Pref. | 120–123 | .. | 4 1 4 |
| 79,416 | ,, | Dec. 28 | 3 | Do. 4 p.c. Deb. Stk. | 102–105 | .. | 3 16 2 |
| 845,872 | ,, | Feb. 28 | 5⅛ | | | | |
| 185,000 | ,, | ,, | 5 | | | | |
| 228,300 | ,, | Dec. 28 | 4 | | | | |

Prices marked * are "Ex div." † Next dividend will be at this rate.

## NOTES FROM SCOTLAND.

**From Our Own Correspondent.**

*Saturday.*

The Informal Meeting of Scottish Gas Managers, which was held in the Grand Hotel in Glasgow on Wednesday, was a very successful gathering. There is but one opinion regarding the address of the President—Mr. J. W. Napier, of Alloa—that it was a most worthy production, giving evidence of careful preparation, and touching with skilful hand numerous points which are of present-day interest to everyone engaged in the production of coal gas. A remarkable and pleasing feature of the address was the absence of history from it. Subjects were taken up as they stand at the present day; and the mind of the author seemed to be directed to a contemplation of potentialities as they affect the future, rather than to a dwelling upon the successes of the past. Mr. Napier's theories and anticipations may not commend themselves to all—he holds this view himself; but there will be a universal admission that they are the outcome of a process of close reasoning, fortified by considerations which have been derived from careful observation. The first business which the meeting took up was the somewhat peculiar one of a request by the Committee of the North British Association to consider what they, the Gas Managers of Scotland, were to do, in their capacity of the Informal Meeting, to perpetuate the memory of the late Mr. James M'Gilchrist. The Committee desired the opinion of the Informal Meeting before they decided anything for themselves. Will the Committee, now that they have passed the matter on to the Informal Meeting, report to the North British Association in July that, now that the Informal Meeting have resolved to found a M'Gilchrist Medal, there is no need for the Association to do anything? That would, in truth, be the quite natural sequel to Wednesday's decision, and the most sensible action they could take. The Informal Meeting owes its existence, and the position it now occupies, to the efforts of Mr. M'Gilchrist. The North British Association owe no such debt to his memory. He was a good member of the Association. But so were others who have gone to their rest; and there has, as yet, been no proposal to commemorate them by special means. If a member of a body is energetic in its cause, he but does his duty. In ordinary cases, after his decease, a tribute to his memory is inscribed in the minutes; and that is held to be enough. If every similar body to the North British Association were to start founding scholarships in memory of departed zealous members, the country would soon be overridden with memorials; and the number would be so many that, in the common ruck, nobody would be commemorated by any one of them. These views may appear to be strong. They are not directed against the proposal to do anything reasonable to commemorate the memory of an esteemed co-worker, but as a caution against allowing an excess of heart feeling to overcome reason and fairmindedness. The form which the Informal Meeting resolved that their commemoration should take cannot be said to be the happiest which could have been adopted. If we cast our mind back, and consider how many of the Past-Presidents of the Informal Meeting are now alive, they will be found to number probably about a dozen. Taking that as the average number of survivors who may be expected to be in survivance at any time, we do not require much reflection to reach the conclusion that to have twelve gentlemen out of the four-and-a-half million inhabitants of Scotland walking about with an inscribed medal on their breast, is not a very extensive commemoration of anyone. Would the provision of a gavel, with which the Chairman would keep the Informal Meeting in order, and a loving cup for use at the dinner, to be handed on from President to President, not have been more appropriate, and easier to handle, than a yearly medal? Some such provision would have been a more tangible, and probably a more perpetual, commemoration than that which has been agreed upon. Mr. Vass threw out the suggestion that the North British Association should take over the Informal Meeting. It is years since I wrote the same view in this column; and I think still that it is the line which should be followed. The gentlemen who attend both meetings are really one and the same, and their objects are the same. Their methods may differ; but this need not be interfered with. The material consideration is that it is a redundancy to have two bodies doing the same work within the same area.

The session of the Western District of the Scottish Junior Gas Association was brought to a close this afternoon by a brilliant gathering at Provan, which was in the nature of a business visit first, followed by an exceedingly pleasant social function. Under the leadership of officials associated with the works, the visitors were shown round, and the working of every part was fully explained to them. It is two-and-a-half years since these great works were opened; and the visit this afternoon brought home the conviction to everyone that they have, in all respects, fulfilled the high anticipations which were formed of them. Everything is to-day being carried through exactly as was intended when the works were first conceived; and in regard to efficiency, every passing season gives more satisfaction than its predecessor. After the inspection, the visitors were entertained at tea, and then spent an hour or two in sociality, with Mr. Alexander Wilson, the Engineer, in the chair. Under the influence of his genial presence, and of the encouraging remarks which he never fails to press upon the members of the Junior Association, the proceedings were characterized by an enthusiasm which is seldom to be found at gatherings of the kind. The occasion was a fitting wind-up to a most successful session; and the form in which the proceedings were arranged was, as the Chairman happily put it, "a very good way to get them all back again."

In another part of the "JOURNAL" there appears an account of the visit of the Eastern District of the Scottish Junior Gas Association to the works of the Broxburn Oil Company, Limited, on the afternoon of Saturday, the 30th ult. It is somewhat late to write here upon it now; but as it was the concluding meeting of the District for the session, the fact may be recorded, and expression given to the pleasure and profit of the visit. The proceedings were, in all respects, on the same lines as the recent visit of the Western District to the Philpstoun Oil-Works, with which I have already dealt; and therefore further comment upon what was seen would be repetition.


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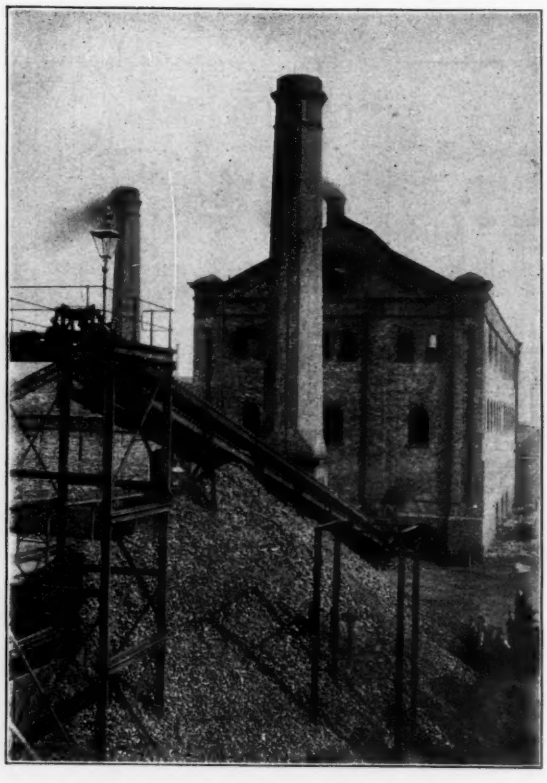

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The venerable, but in later years rejuvenated, body known as the Convention of Burghs held their annual meetings in the old Parliament Hall in Edinburgh on Tuesday and Wednesday of this week. The session of the Convention lasts for two days. During the remainder of the year, whatever business falls to be done is looked after by what is known as the Annual Committee. This Committee reported on Tuesday that they had considered a resolution which had been adopted at the meeting of the Convention the previous year, relative to the provisions of the Burghs Gas Supply (Scotland) Act, 1876. The resolution set forth that since the repeal of the General Police and Improvement (Scotland) Act of 1862, there was no provision for taking a poll of the inhabitants of a burgh upon the question of the adoption of the Act of 1876, as provided in section 5 of that statute. Having considered the matter during the year, the Annual Committee submitted a draft clause, which they recommended should be inserted in a Bill to amend the Town Councils Act. In this clause it is recommended that the provision in section 5 of the Act of 1876 relating to the taking of the poll should be repealed, and that in lieu thereof it should be enacted that, in the event of a remonstrance by twenty ratepayers being lodged with the Town Clerk, the resolution to adopt the Act should not be carried into effect unless confirmed by the majority of the municipal electors of the burgh, qualified under the Acts of 1900 and 1903, voting at a poll.

## CURRENT SALES OF GAS PRODUCTS.

### Week ending April 6.

There was not much business done on the London market last week, in consequence of the holidays. All the tar products, however, remain in a firm condition. Deliveries of pitch are being readily taken, and stocks are low. Manufacturers of this article are practically sold out for this half year, and quote 28s. to 29s. net for September-December. Ordinary London creosote oil is in large demand; the price being 2¼d. to 2⅜d. net in bulk at the makers' works, and considerable business is reported at about 2⅜d. Sulphate of ammonia is still featureless; the value being £11 17s. 6d. to £12 on Beckton terms.

**Sulphate of Ammonia.** LIVERPOOL, *April* 6.

There has been a quiet market throughout the week; but, although the tone is easier, the quotations at the close remain £11 15s. per ton f.o.b. Hull, £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. Although buyers are asking for deliveries on April contracts, and in some cases pressing for them, they are in no hurry to make further purchases; and their attitude is no doubt dictated by speculative offering at a discount in the forward position. Home demand has been good; the season being rather late, and buyers having hitherto hung back in regard to further purchasing. For delivery ahead, the situation is unchanged; the large makers still holding out for £12 per ton for delivery over the summer and autumn months, while smaller makers are willing to accept £11 17s. 6d. per ton f.o.b. Buyers, however, are indifferent, and actual business done has again been limited.

**Nitrate of Soda.**

This article, notwithstanding the weaker statistical position at the end of March, is firm, both for prompt and for delivery over the season; and spot prices remain 11s. 6d. per cwt. for 95 per cent., and 12s. per cwt. for refined quality.

**Tar Products.** LONDON, *April* 6.

As is usual during holiday week, markets have been very quiet. Pitch is without change, and there is practically nothing doing. One or two small transactions have, however, taken place on the east coast at 25s.; while in Liverpool 24s. and in Manchester 23s. have been accepted. There is some inquiry from South Wales for July-December, but only at very low figures; while on the Continent, matters appear to be at a standstill. Creosote is very firm, especially in London, where makers continue to refuse to quote, having practically nothing to spare. In the Midlands, also, the scarcity continues, though a little business has taken place at 2½d. per gallon. In the North, some transactions have passed at 2⅛d. at makers' works; but buyers generally now report that they have covered all their requirements. Benzol, 90 per cent., remains quiet; but business has been done at 10½d. in London for delivery to the end of the year, and Manchester dealers report sales at 10d. Benzol, 50-90 per cent., is weaker in sympathy with 90 per cent.; and it would now be possible to buy some quantity in London at 11¼d. On the east coast, 10¾d. has been accepted. In solvent naphtha, the demand for London qualities continues; but there is practically nothing available, and high prices would have to be paid for any small quantities which might be offered. On the east coast, things are somewhat quieter. There is nothing to report in toluol, as makers have practically nothing to sell. A further small transaction has taken place in anthracene, "A" quality, at 1½d. per unit; but there is no change in the position. In carbolic acid, Continental consumers continue to offer 1s. 8d. f.o.b. on the east coast; but the English consumers have, if anything, reduced their ideas, and now speak of 1s. 7d. at makers' works. Crystals are very quiet; and it is possible that something under nominal quotations would be accepted for any important business, if it should be offered.

The average values during the week were: Tar, 14s. to 18s. Pitch, London, 25s. 6d. to 25s. 9d.; east coast, 25s. to 25s. 3d.; west coast, 24s. to 24s. 3d. Benzol, 90 per cent., 9¾d. to 10½d.; 50-90 per cent., 10⅜d. to 11¼d. Toluol, 1s. 2d. to 1s. 2½d. Crude naphtha, 4⅝d. to 5d.; solvent naphtha, 1s. 1½d. to 1s. 3⅝d.; heavy naphtha, 1s. 2d. to 1s. 4d. Creosote, London, 2¼d. to 2⅜d.; North, 2d. to 2⅛d. Heavy oils, 2¾d. Carbolic acid, 60 per cent., 1s. 8d. to 1s. 8¼d. Naphthalene, £6 10s. to £10; salts, 32s. 6d. to 37s. 6d. Anthracene, "A" quality, 1½d. to 1⅝d.

**Sulphate of Ammonia.**

Markets remain in practically the same position, and there is no demand. The principal Gas Companies still speak of £12 as their


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nominal quotation; but on ordinary London terms business has been done at £11 17s. 6d. In Leith, £11 18s. 9d. may be taken as the outside value; but nothing is being done. In Liverpool, £11 16s. 3d. has been accepted; and at Hull, £11 15s.

## COAL TRADE REPORTS.

**Lancashire Coal Trade.**

Business continues on steady lines at previous quotations. House coal, however, is in lessening request. So much fuel, nevertheless, is required for steam, boiler, and export requirements that a good general trade is practically assured for a long time ahead. Contracts for gas coal and cannel are being entered into almost daily at increased rates. The readiness with which the further 5 per cent. advance in the wages of miners was recently granted by the Coal Conciliation Board furnishes ample evidence of the successful character of the coal trade in this part of the country.

**Northern Coal Trade.**

There is now a normal production of coal, so that the stocks that were reduced in the holidays are now being enlarged; and with tonnage fairly plentiful, there are fuller shipments. In the steam coal trade, best Northumbrians are now quoted at about 15s. per ton f.o.b., second-class steams are from 13s. to 13s. 6d., and steam smalls are firm at from about 8s. 9d. to 9s. 3d. Production at the collieries is well maintained; and, on the whole, the output is readily taken up. In the gas coal trade, the inquiry is steady—there being an increased demand for export, though that for home use naturally decreases at this season. As to price, Durham gas coals vary from about 12s. to 13s. 6d. per ton f.o.b. Very little has been done, as far as is known, in the large contracts for gas coal for the Metropolis. It is believed, however, that negotiations have been carried on, and that some settlement has been made with collieries, though none of the details have as yet transpired. At the same time, there is believed to be a wide margin between the prices asked by other collieries and that offered, so that a full settlement of the contracts is delayed. Coke is firm; and gas coke is quoted at higher prices—being rather more scarce. Good gas coke is from 15s. to 16s. per ton f.o.b.

**Scotch Coal Trade.**

There is a well-sustained demand for all classes of coal except household, the price for which has, according to custom at this season, been reduced by 6d. per ton. There is a prospect of a very large request for shipping purposes, and consequently the outlook is, in the meantime, not very encouraging for buyers. The prices quoted are: Ell 12s. to 13s. 9d. per ton f.o.b. Glasgow, splint 13s. to 13s. 3d., and steam 11s. 9d. to 12s. The shipments for the week amounted to 295,568 tons—an increase of 43,100 tons upon the preceding week, and of 25,518 tons upon the same week of last year. For the year to date, the total shipments have been 3,149,762 tons—an increase of 202,711 tons upon the corresponding period of 1906.

**Durham Coal Contracts.**

The "Glasgow Herald" says: "It is reported on the Newcastle Coal Market that the Paris Gas-Works have just concluded arrangements for a large quantity of Durham gas coals, said to be over 1,000,000 tons, covering part of their requirements over the next two years. The coals have to be shipped to Rouen and thence railed to Paris, and the prices, which are 'delivered in that city,' are understood to average about 12s. per ton f.o.b. Tyne, which, considering the extended period of the contract, are regarded as good figures. It is further reported that, in addition to their recent purchase of Yorkshire and Derbyshire coals, the Gaslight and Coke Company have also arranged for a considerable quantity of Somerset coal to be delivered by rail."

**A Scottish Coal Combine.**

"Negotiations are now in progress," says the Press Association's Dunbar Correspondent, "for a huge coal combine, in which quite a large number of the principal collieries in East Lothian and Midlothian, which is a leading centre of the mining industry in Scotland, will be embraced. The capital of the combine, it is believed, will amount to about £1,250,000 sterling. The collieries concerned employ about 7000 men, and it is expected that the combine will lead to a much greater development of mining throughout the East of Scotland."

**The Contracts for Gas Coal.**

Referring to this matter yesterday, the "Newcastle Chronicle" said: "The large gas coal contracts which are usually settled at this season have this year lingered greatly in the negotiation. There has been friction between the buyers and the sellers; and a not inconsiderable part of the contracts has been placed with collieries in Yorkshire and even further south. The advance that has taken place in the market price of coal during the last few months shows itself very prominently to those who make their contracts yearly; and as there was a higher price quoted, and generally paid, for the coal that was contracted for in the spring of last year, the further and heavier advances that have now been asked make the quoted prices matters of great moment to the companies who use such large quantities of gas coals. The matter is also one that is very important to the county of Durham, for the gas coal collieries of that county used to supply the bulk of the coal for the great contracts of the Metropolitan Companies. Last year they lost a part of the contracts, and this year they have lost a heavier portion. It is possible that there is more than the mere question of price in the matter, for some of the expressions that have been used show the presence of temper that ought not to be found in business transactions. The Companies have placed a part of their contracts, as we have said, with southern coalowners; and it remains to be seen how the larger portion of the coal that is needed will be allotted. In the meantime, the prices in the market keep firm; and as far as any tendency is evident, there is some indication of a further increase in the cost of production—an increase that may be more evident when the ascertainment of the next realized price is made. There are still large contracts to be placed; and it would be well for both buyers and sellers if they were early and amicably settled."


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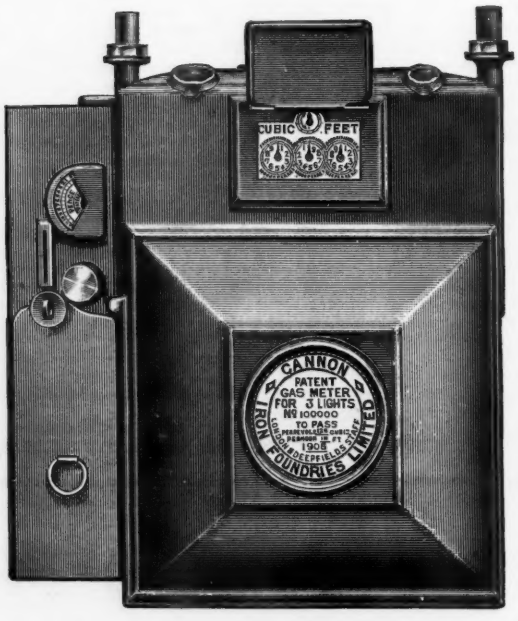


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### Gas Stoves and Engines as Smoke Preventers.

In the annual report recently issued by Dr. Francis J. H. Coutts, F.C.S., the Medical Officer of Health for Blackpool, he recommends the extended use of gas stoves and engines as a preventive of fog. He says: "Gas-fires placed in a proper position, so that the products of combustion are properly carried away up the chimney, are much cleaner than, and, I believe, quite as healthy as, a coal fire; so that the wider adoption of gas for heating purposes would save labour, and would tend to reduce considerably the amount of soot thrown into the atmosphere from coal fires. For factories and works, I should think that, with the present improved gas-engines, provided gas were supplied at a reasonable rate, it would be cheaper to use gas for motive power, even where considerable horse power was required, than to put down expensive boilers and build tall chimneys." He expresses the hope that those starting new industries in the town will be encouraged to use gas or electricity as motive power, as this will tend to "keep our atmosphere clear and unsullied by smoke."

### Extensions at the Doncaster Gas-Works.

Owing to the rapid increase in the consumption of gas at Doncaster and its vicinity, the Corporation have decided to carry out at once a further extension of the gas-works. It is proposed to enlarge No. 2 retort-house and coal-stores by 85 ft. 6 in., which will make their total length 176 ft. 6 in. The extended buildings will be covered by iron roofs, and when completed will contain five additional through beds of retorts, heated on the gaseous system. The coal-conveyors into the new coal-stores are to be extended, and the machinery altered to meet the new conditions. When this retort-house is completed, it will be capable of making 1¼ million cubic feet of gas per diem. The maximum output at present is 1 million cubic feet. The whole will be carried out, at an approximate cost of £7000, to the plans and under the supervision of Mr. Robert Watson, the Gas Engineer and Manager to the Corporation. The Gas Committee have accepted the contract of Messrs. S. Beastall and Sons for the erection of the new retort-house; the amount being £3300. The retort-beds will be in the hands of Drakes Limited, of Halifax, who will also carry out the ironwork necessary for them.

### Liverpool and the Supply of Gas to Fazakerley.

A report has been prepared by Mr. Isaac Carr, in connection with the scheme of the Liverpool Corporation to supply gas to Fazakerley, in which he states that the proposed site for the works the Corporation purpose erecting comprises 3¼ acres of land on the south side of the Lancashire and Yorkshire Railway. The site has special advantages, in being the lowest point in the district; and it easily lends itself to the construction of works in which the manufacture of gas can be economically carried on. The mains to be laid vary from 12 to 4 inches, and are of sufficient capacity for the distribution of 50 million cubic feet of gas per annum. The estimated annual consumption of gas at the outset is 12 million cubic feet; but there is every reason to believe that in one or two years this would reach 20 or even 30 million feet. The maximum price named in the Order is 4s. 6d. per 1000 cubic feet; but gas of 20-candle illuminating power can be supplied at a charge of 2s. 6d. with an annual consumption of 12 million feet. With a consumption of 20 to 30 million feet per annum, a selling price of 2s. 6d. would provide a surplus after paying all charges. The estimated total outlay on the 12 million feet works is £14,025, on a 20 million feet works £17,301, and on a 30 million feet works £20,000. The gas supplied will be the same quality as that of the Gas Company—namely, 20 candles—but will be exclusively coal gas, enriched with cannel and benzol. The manufacture of water gas is not contemplated.

**Stockport's Gas Profits.**—At the meeting of the Stockport Town Council last Wednesday, Mr. Brewster, referring to the Gas Committee's proposal to hand over £13,000 in relief of the rates, as representing the profits on the year, said he did not object to the rates being relieved, but thought the £13,000 did not fall equally on the different ratepayers. There were large concerns where not a single pennyworth of gas was consumed, and where the owners used electricity which they generated themselves, and which was of no benefit to the Corporation departments. Mr. Fernley, the Chairman of the Gas Committee, in reply, said the question raised by Mr. Brewster had previously been brought under the notice of the Committee. "The sun shines on the just as well as on the unjust," added Mr. Fernley, "and the people who do not use gas get the benefit of the gas profits as well as the consumers of gas; but it should be remembered that these people are also large ratepayers in the town."

At the quarterly meeting of the Northumberland Coal Conciliation Board last Saturday, an advance of 5 per cent. was conceded to the men, as a result of the recent coal boom. This is the sixth successive quarterly advance, and the largest single advance since 1900.

We have received from Mr. Herbert O. S. Cooke, a useful little work, entitled "Success in the Office," which has just been published for him by Messrs. Simpkin, Marshall, and Co., at the price of 2s. The author is one of the staff of the Portsmouth Water Company, to whose Secretary (Mr. J. L. Wilkinson) the book is dedicated. It contains a number of valuable hints, the committal of which to the memory of the average clerk will go far to realize the author's hope of making him more self-reliant, and less dependent upon a senior for advice.

The report of the Directors of Messrs. Newton, Chambers, and Co., Limited, for the year ended Dec. 31 last, sets forth that, after allowing for depreciation, the profit amounts to £32,996, and with the balance brought forward there is an available total of £50,773. Debenture interest absorbs £3214, and £10,000 has been reserved towards the erection of new coke-ovens. The Directors recommend the payment of dividends at the rate of 6 per cent. per annum on both preference and ordinary shares, and also a further distribution of 3 per cent. on the ordinary shares on account of 1905. A balance of £14,387 will remain to be carried forward.


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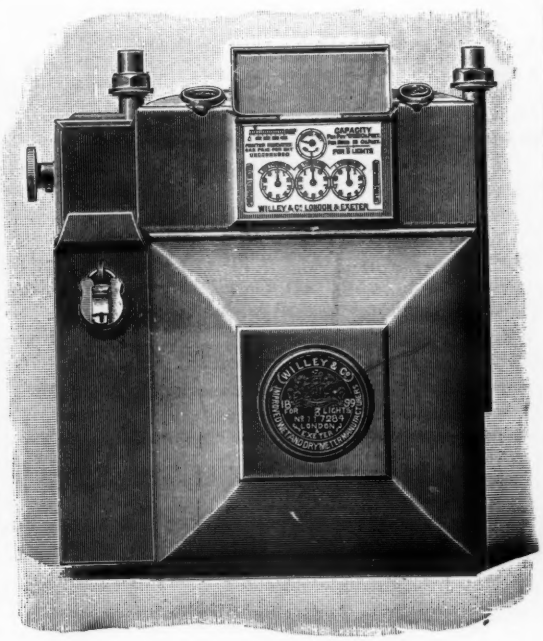


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John Wright and Eagle Range, Limited, have obtained, in open competition, the contract for the sole supply of gas-cookers to the Skelmersdale Urban District Council.

The Long Eaton Gas Company have placed the order with Messrs. Robert Dempster and Sons, Limited, of Elland, for four 30 feet square purifiers on Green's dry-lute principle, as recently advertised for in our pages.

The Incandescent Mantle Company, Limited, has been registered with a capital of £22,000, in £1 shares (2000 preference), to acquire the business of the Buhlmann Incandescent Syndicate, Limited, and to adopt an agreement between them and H. A. Grimsdick, the Liquidator, of the first part, G. B. Clark and S. Simmelkjoer of the second part, and W. A. Bread of the third part; and to carry on the business of manufacturers of, and dealers in, incandescent mantles, gas-burners, &c. There will be no initial public issue. The first Directors (not less than three nor more than seven) are to be appointed by the signatories; and the qualification (except for J. Norden or any Director nominated under the above agreement or by the United Chemical Works, Limited, under any agreement the Company may enter into with it), is £100.

The tender of Messrs. Newton, Chambers, and Co., Limited, for £5649, has been accepted for the construction of a three-lift gasholder and steel tank for the Wolstanton Urban District Council. Tenders were invited in our issue for the 5th ult.

Messrs. Joseph Taylor and Co. have completed for the Kingston-on-Thames Gas Company an order for one of their latest builds of solid plate lead saturators, including mother-liquor tank, draining-table, overhead acid tank, the lining of the sulphate store (41 ft. 6 in. by 32 ft.), and the raising of the walls 6 ft. 6 in. The lead on the bottom of the store is 10 lbs., and is carried up 4 inches all round; thereby forming an acid-proof tray. The other sheets are brought over and lead-burned on the bottom. The order included a plate lead ammonia and acid catch-box, a plate lead acid egg, seal-pots, lead syphons, acid cocks, an 8-inch mother-liquor elevator, and various lead bends and connecting-pipes. The whole of the leadwork about the plant is so arranged that no liquor can leak and enter any portion of the ground or foundations in the sulphate-house, but is caught and conveyed back to the mother-liquor tank. The total weight of lead used in connection with this work was about 25 tons.

## WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

**Situations Vacant.**

DRAUGHTSMAN. Oldham Gas Department. Applications by April 15.
FOREMAN GAS-FITTER (BRAZIL). Gasco, c/o. Streets, Cornhill.

**Situation Wanted.**

WORKING MANAGER OR FOREMAN, &c. No. 4753.

**Partnership.**

GAS TESTING AND SCIENTIFIC APPARATUS BUSINESS. No. 4754.

**Plant, &c. (Second-Hand), for Sale.**

PURIFIERS, &c. Stratford-on-Avon Gas Department.
STATION METER AND WASHER-SCRUBBER. Chester Gas-Works.

**Stocks and Shares.**

BRENTFORD GAS COMPANY. April 23.
CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY. April 23.
ILFORD GAS COMPANY. April 23.
IMPERIAL CONTINENTAL GAS ASSOCIATION. April 23.
NEWCASTLE AND GATESHEAD WATER COMPANY. April 22.
SOUTH SUBURBAN GAS COMPANY. April 23.
SOUTHEND WATER COMPANY. April 23.

**TENDERS FOR**

**Benzol, Light Oil, and Naphtha.**

BRIDGEWATER COLLIERIES. Tenders by April 22.

**Coal and Cannel.**

ARBROATH GAS DEPARTMENT. Tenders by April 29.
BODMIN GAS CONSUMERS' COMPANY. Tenders by April 29.
INVERNESS GAS COMMISSIONERS. Tenders by April 20.

**Condensers, &c.**

BELFAST GAS DEPARTMENT. Tenders by April 18.

**Cookers.**

PONTYPRIDD GAS DEPARTMENT. Tenders by April 29.

**Fire-Clay Goods.**

WALLASEY GAS AND WATER DEPARTMENT. Tenders by April 18.

**Gasholder and Tank.**

BARNOLDSWICK GAS DEPARTMENT. Tenders by April 24.

**General Stores, Iron Bars, Steel Plates, Lead Pipe, Oils, Paints, Tin, &c.**

WALLASEY GAS AND WATER DEPARTMENT. Tenders by April 18.

**Meters (Gas and Water).**

WALLASEY GAS AND WATER DEPARTMENT. Tenders by April 18.

**Pipes, &c.**

WALLASEY GAS AND WATER DEPARTMENT. Tenders by April 18.

**Lime.**

INVERNESS GAS COMMISSIONERS. Tenders by April 20.

**Residual Product Works, Lease of.**

GLASGOW CORPORATION. Tenders by April 22.

**Sulphuric Acid.**

BURY GAS DEPARTMENT. Tenders by April 15.
WALLASEY GAS AND WATER DEPARTMENT. Tenders by April 18.

**Tar and Liquor.**

COLNE GAS DEPARTMENT. Tenders by April 17.
GLASGOW GAS DEPARTMENT. Tenders by April 22.
MACCLESFIELD GAS DEPARTMENT. Tenders by April 16.
MOUNTAIN ASH GAS DEPARTMENT. Tenders by April 23.

**Valves, Cocks, Hydrants, &c.**

WALLASEY GAS AND WATER DEPARTMENT. Tenders by April 18.

## NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

*No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.*

**COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.**

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